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# Electrical World

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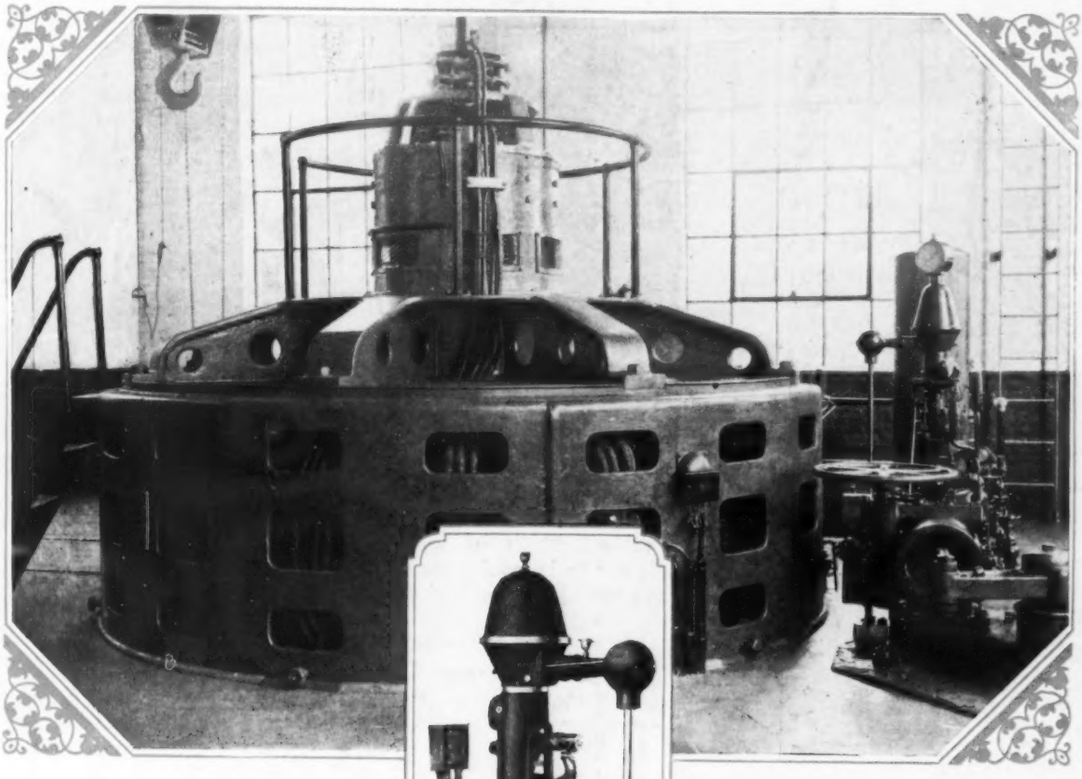

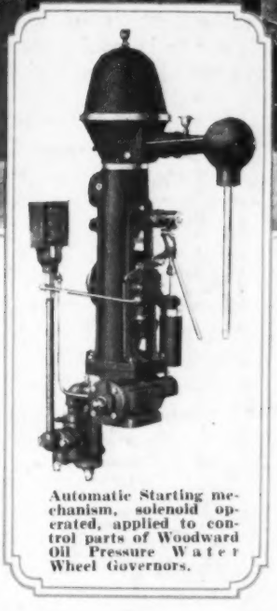

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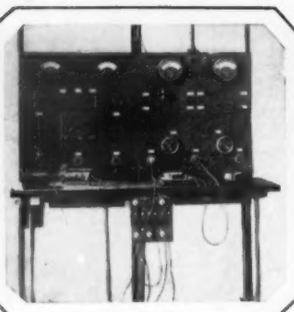

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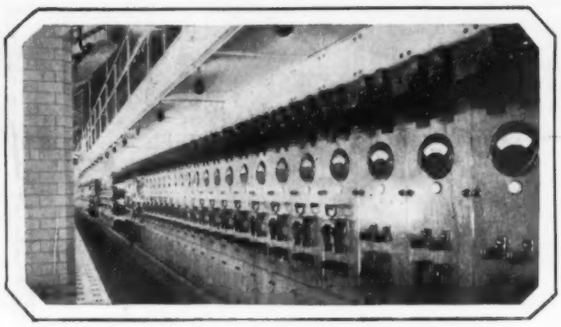

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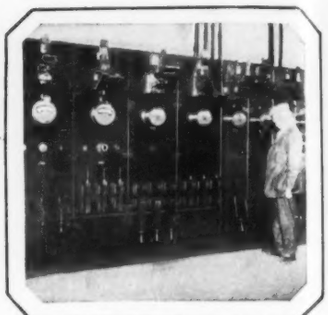

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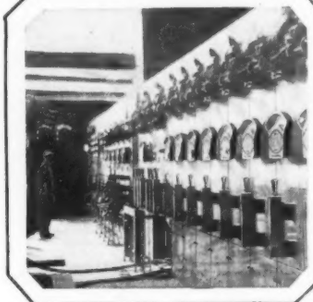

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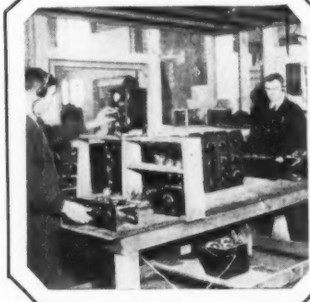

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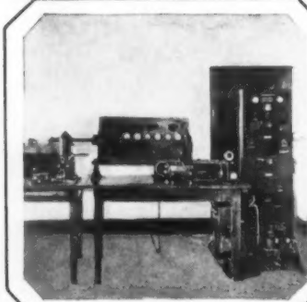

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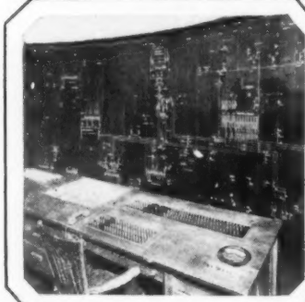

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# Electrical World

THE CONSOLIDATION OF ELECTRICAL WORLD, ELECTRICAL ENGINEER AND AMERICAN ELECTRICIAN

*Published by McGraw-Hill Company, Inc.*

W. H. ONKEN, JR.

*Editor*

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## The President Seals the Verdict

"LIKEWISE the policy of public ownership of railroads and certain electric utilities met with unmistakable defeat. The people declared that they wanted their rights to have not a political but a judicial determination, and their independence and freedom continued and supported by having the ownership and control of their property not in the government but in their own hands." These words from President Coolidge's inaugural address, carried by radio and type to uncounted millions of hearers and readers, in a sense sealed the verdict of the polls last fall, so heartening to every believer in private initiative. The President's utterances sink deep into the popular mind. His teachings of fundamental economic truth are far-reaching, and his belief in the private ownership of utilities has more than once been effective in guiding public opinion to sound conclusions. The future rests with the utilities themselves, and if progress continues upon the lines of sound financing, fair rates, high-quality service and good public relations, the outlook will indeed be bright and the pathways of service will lead to successes which even the present superb development of the electrical art does not approach.

## The True Test of Good Buying

IT MEANS as much to the profits to save a dollar as to make a dollar. Anybody will admit this. But it is not always so readily apparent that a lot of money can be wasted in an overzealous effort to save. Yet it is frequently observable that the purchasing department of a company can build up such an elaborate plant and system for the improvement of "purchasing efficiency" that the cost of "buying close" is greater than its savings.

In a recent instance the purchasing agent of a fair-sized utility became enthusiastic over the possibilities for obtaining lower prices on larger quantities of material if he only had a large warehouse in which to store his purchases. He made a strong case on paper, took it to his executive and convinced him that the idea was good. The warehouse was constructed and the company began to drive better bargains through larger discounts for increased quantities. But the time came eventually to cast a reckoning, and it developed the fact that warehouse and stock costs had added a very heavy item to the "price" of these purchases. On one kind of material, a heavy item in the year's buying, the stock turnovers were reduced to two a year and it was costing the company 25 per cent additional in warehousing, handling and interest on investment. This same stock could have been purchased out of a neighboring jobber's warehouse as required for 10 per cent over the price that had been paid.

It is the cost of material at the point of use that makes the final charge against the profits, not the fancy discount that may be obtained from the supplier's salesman. The true measure of purchasing efficiency which the executive should watch is not a comparative report of better prices gained, but a study of the actual expense of laying down the purchased goods where and when they are required.

## Constructive Activity in Engineering Education

FOR years it has been possible to obtain multitudinous opinions about the objections and methods in vogue in engineering education. Every one apparently has had positive opinions to express and is delighted to present them. Recently, however, opinions have been displaced by facts in great degree, and this has resulted largely from the stimulus given engineering educational studies by the grant of the Carnegie Corporation. A recent progress report of the committee in charge of the work contains constructive material and outlines actions which promise to produce worth-while results. Special committees are working in the faculties of 101 engineering colleges on positive and definite schedules. This program now covers studies of present practices and past experiences of engineering colleges, occupational demands for graduates, the relations of colleges to professional organizations, educational psychology and European educational methods.

In addition to prescribing these studies, the inspiration and initiative of Director Wickenden have brought about definite co-operative work with the engineering societies, the American Council on Education, the National Industrial Conference Board, the United States Bureau of Education and other organizations. These organizations are carrying on extensive investigations which fit in with the whole program. For example, the National Industrial Conference Board has compiled an instructive report on technical graduates in the pulp and paper, rubber, textile and metal trades industries and has drawn very pertinent and positive conclusions. These may be condensed in the statement that technical men are needed in these industries, that there should be more contact between the industries and the colleges, and that the industries should continue to train men after graduates enter their service.

An instructive tabulation of engineering students enrolled each year from 1921 to 1924, prepared by the United States Bureau of Education, shows an enrollment of 52,833 students in engineering in 1924-5, divided as follows: Civil, 13,690; mechanical, 10,084; electrical, 16,656; chemical, 4,108; mining and metallurgical, 1,563; all others, 6,732. It is interesting to note that enrollments in all branches excepting electrical and civil engineering have decreased since 1921.

The whole object of these studies is not to standardize courses or objectives. Rather it is purposed to assemble data which each school can use as an authoritative foundation for building its curricula and for de-

veloping its educational methods. Every encouragement should be given the work, for the educational plant of this country is fundamental to progress and it needs the best brains and the best methods possible for its efficient operation.

## Conscienceless Questionnaires

THE electrical industry has grown weary of questionnaires and is becoming indignant over their ceaseless importunities. Beginning some years ago as a convenient means of developing mass facts and statistics, the habit has grown until the printed or typewritten questionnaire has become a conscious burden to the executives of electric light and power companies. The purpose behind them is right enough. It is of great value to the industry that facts be known and figures be compiled to guide men's thinking. But the methods of the perpetrators of the modern questionnaire are bringing down curses upon their heads, and retribution is following fast, because a larger and larger proportion of these organized inquiries are falling into the maw of the waiting wastebasket.

It is probable that the press has been overzealous too at times, but the greatest offenders are by common repute the committees of associations. A committee undertakes the preparation of a report and initiates an investigation. Preparations are made to elicit information from the entire country. Each member of the committee may suggest a few questions that appeal to him and insist on their importance. A questionnaire is built up that, when loosed upon the unoffending companies, calls for information sometimes demanding days and days of work by a skillful, important and expensive man. About the time that this questionnaire goes out some other committee of another association is likely to launch another double-barreled appeal, perhaps asking the same men for the same information, but combed over the other way and hashed up in another form.

All this is not just embarrassing. It is worse than that. It brings a woeful waste of time and money. One general manager recently declared that it would require the entire time of an experienced engineer to attempt to answer all the questionnaires that he is receiving nowadays. Another executive showed on his desk the responses to five exhaustive questionnaires that had just been completed and signed, and pointed in his wastebasket to a whole bundle of other questionnaire forms which had been accumulating until he had that day cast them out in disgust. In short, excessive demands result too often in haphazard replies or no response at all.

The industry appreciates that the questionnaire is an effective instrument for use in developing mass facts from the experience of many men. The average executive is quite ready to do his part. He is glad to contribute his share of information for the good of the industry, even though he sees no immediate personal benefit to come of it. But he wants the questionnaire to show a bit of conscience. He wants it to ask only for vital information that appeals to his common sense as offering promise of some good to the industry. He is tired of going to a lot of work to answer questionnaires from which he never sees any results.

To meet this criticism, therefore, every committee and every publication and every individual that go to the industry with a questionnaire should carefully observe these three rules, disregard of which seems to be the principal source of irritation:

1. Do not ask too many questions.

2. Ask for information that can be gleaned from existing records and will not require special research. If research is necessary to the purpose, then it should be frankly discussed through correspondence and its importance "sold" to the industry in advance of the questionnaire.

3. Interpret the questions so that they will appeal to a man's common sense as having a practical objective promising real value, and not perhaps appear merely to reflect the curiosity of some individual on a committee.

## Correct Color Theory and Practical Considerations in Color Lighting

THE principles of color mixture underlying dyeing and painting are much more widely known than the more fundamental ones pertaining to the mixture of lights and of color sensations. Therefore it is not surprising that the architect, the decorator and many others consider red, yellow and blue to be the primary colors in lighting effects instead of the correct ones—red, green and blue. Without going into the details of the matter, it may be said in passing that even for the mixture of dyes and pigments red, yellow and blue are not the correct primaries. The red must actually be purplish, like magenta, and the blue must be blue-green. These are termed "subtractive" primaries because the result of mixing dyes and paints is subtraction. The resultant color is that remaining after the light transmitted by one dye or pigment is further reduced in certain wave lengths by passing through another dye or pigment, and so on. A proper mixture of the subtractive primaries produces black; that is, opacity to light.

In the mixture of colored lights an additive process is involved. For example, if one permits primary red light to fall upon a white or gray surface, the latter will appear red. If primary green light is added in proper quantity, the surface will appear yellow. Then, if primary blue light is added in correct amount to this yellow, the surface will appear white or gray. Thus the additive principle becomes obvious. If those who have a problem in color lighting will keep this fundamental principle in mind, much confusion will be eliminated.

It is possible by mixing primary red, green and blue lights to produce a tint or shade of any dominant hue desired. Incidentally, a shade in lighting is merely a matter of quantity of light. Theoretically, one needs only these three colors in order to produce any desired color or intensity. Practically there are many interesting aspects. For example, the various yellows are important colors, and it is better to produce them directly with a yellow filter than by mixing red and green lights. In practice, therefore, a more desirable set of filters is red, yellow, green and blue.

Furthermore, it is more efficient to produce a tint of a color, say red, by mixing colorless (unfiltered) light with it instead of making the colorless light by mixing red, green and blue lights and obtaining the red tint by an excess of red in the mixture. Therefore, from a practical viewpoint, a still more desirable set of filters is red, yellow, green, blue and clear (colorless). These

are important considerations when a system of color lighting is to be designed. Of course, space may not permit five circuits or even four, but when it does the choice should be guided by understanding of these fundamentals and not merely by color theory—even correct color theory.

In order that these practical considerations may be applied to lighting, colored accessories are available in the four colors—red, yellow, green and blue. Incidentally, great advances have been made in recent years, for these are now available in durable and efficient colored-glass plates and caps for equipment of fairly high wattage.

## Economics a Perpetual Challenge to the Engineer

ENGINEERS often assert that the efficiency of apparatus of various types is now so high that little incentive remains to stimulate the ingenuity and originality of the designer in certain fields, and the assertion, singularly enough, generally goes unchallenged. Well may the electrical industry be proud of the efficiency of the modern transformer and of the industrial electric oven, for example; but even if this figure exceeded the celebrated "99.44 per cent pure" of commerce, there would still be a powerful incentive for engineering development, not in operating efficiency, of course, but in the two vitally important fields of increased service reliability and reduced manufacturing cost. Without reflecting in the least upon the ruggedness of design of the equipment above mentioned and its service record, the challenge is ever present to produce all apparatus at lower costs and so to benefit its user for all future time. In attacking such problems as how to obtain maximum efficiency with less material, how to insure greater reliability with less costly material, how to manufacture at lower labor expenses and at reduced overhead costs, the engineer picks up the economic challenge of the age and in collaboration with the research laboratory on the one hand and the distributing organization on the other faces well-nigh limitless opportunity for service to the world.

## Pyro-Electric Theories of Insulation

THE general nature of the influence of high temperature on insulation has long been known. Particularly in the case of fibrous and impregnated insulation it has been recognized that increasing temperature means increasing conductivity, that is, decreasing insulation resistance. It is only in recent years, however, that connection between these facts and the breakdown of insulation under high voltage has been recognized. It is only in the last few years that this matter has been studied in a systematic manner. In 1920 a paper was published in Sweden discussing the breakdown of the condenser type of bushing as a heat phenomenon. The connection between dielectric loss and the liberation of heat, in their bearing on the temperature of insulation, was pointed out by Steinmetz in 1902. The paper of K. W. Wagner in 1924 concentrated engineering attention on the matter in a very definite manner.

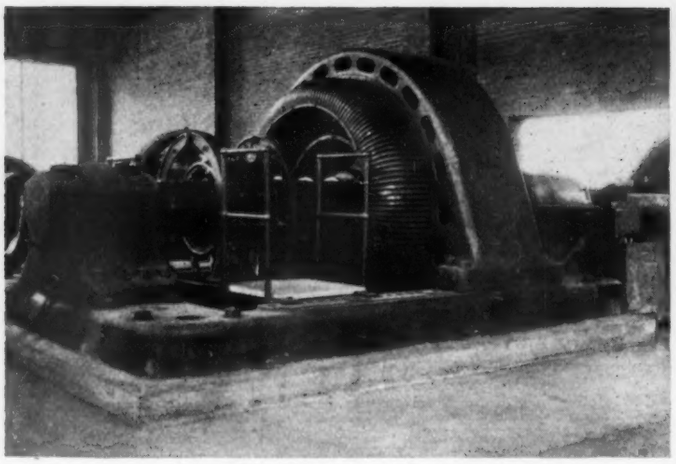
This so-called pyro-electric theory of Wagner is quite widely quoted in this country, and abroad it has led to several critical studies of the correctness of his assumptions and conclusions. These studies, while they have questioned sharply Wagner's analysis and conclusions, have nevertheless served to clarify the problem considerably and they leave it reasonably sure that, ultimately at least, breakdown of fibrous insulation does occur as a heat phenomenon. According to the analysis of Rogowski and Dreyfus, it is not sufficient to assume, with Wagner, that sheet insulation has individual local filaments of weakness. These may occur in very thin sheets, but for most cases the insulation must be considered as approximately homogeneous. In these cases the generation of heat takes place uniformly, if the electric field is uniform, and conditions of breakdown are determined by the dielectric loss and also by the conductivity for heat of the material, its thickness and the temperature of the electrodes. One of Wagner's conclusions was that the breakdown voltage of sheet insulation is approximately proportional to its thickness. This conclusion, however, is due to his failure to consider completely all of the paths for the flow of heat. The more accurate studies indicate that the breakdown voltage increases more slowly than in proportion to the thickness and, in fact, lead to the somewhat startling conclusion that with increasing thickness the breakdown voltage approaches a constant value. This result of the theory would appear to offer an excellent opportunity for experimental tests of its accuracy. The story is as yet far from completely told, but a very much better knowledge of the properties of fabricated insulation has certainly been acquired.

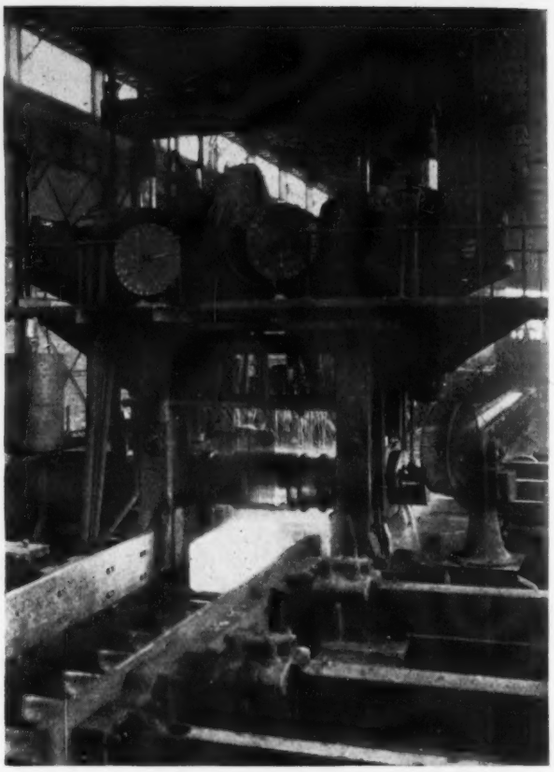
## Orphan Refrigerators Will Be Costly Disappointments

IT IS inevitable that with the growing interest in domestic refrigerators there should be a rapid increase in the number of manufacturers who produce them, and within national and economic limits this is desirable. The electric household refrigerator is still in the process of evolution. Futher innovations will appear, and out of this will come new ideas and new developments along independent lines that will advance the art. History will in this be but repeating itself according to its habit. But it is to be hoped that the electrical industry is not to be called upon painfully to nourish and support a flock of ill-conceived and hastily accepted orphans which must be harbored to protect the good name of the family.

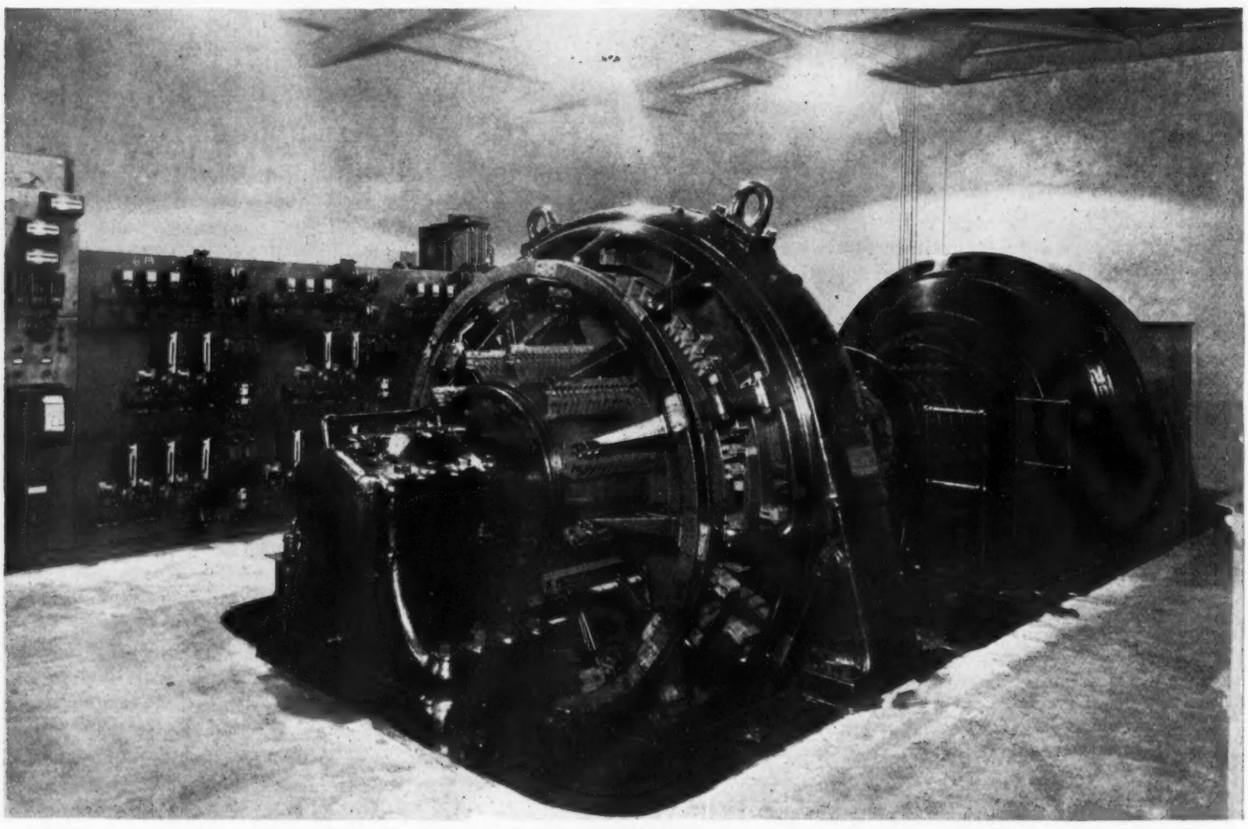
It is of importance, therefore, that any central-station company that contemplates the active promotion of a domestic refrigerator should not only make sure of the mechanical and electrical perfection of the equipment itself but investigate no less carefully the financial status and the history of the organization that manufactures it. The first essential is, of course, a good machine, but before money is invested in the educational development of a local appreciation and demand for that machine it should be established that this good machine is made by a good company that is sufficiently well established financially to insure permanence.

Much selling and much money will be spent through the next few years in the upbuilding of local popularity for the electric refrigerator everywhere. It will pay to make the campaign in behalf of units correctly designed and made which will have the unflinching support of their manufacturers, will progress with the further evolution of refrigeration and will hold their place before the public year after year.





# The Steel Industry Is Now Almost Completely Electrified and Many New Installations Are Planned



DURING the past year many new and special applications of electricity in steel mills have been made. Among these are the two installations shown herewith. The two upper illustrations show the installation of a 40-in. reversing blooming mill at the Otis Steel Company in Cleveland. The reversing motor is a double-unit machine consisting of two armatures mounted on a common shaft. The motor is rated at 6.500 hp., 50/120 r.p.m.. and is capable of delivering a maximum of 17,000 hp. at a speed of approximately 50 r.p.m.

Power for this reversing motor is obtained from a flywheel motor-generator consisting of two 2,700-kw. generators on a 3,750-hp. induction motor and one 50-ton flywheel operating at 375 r.p.m. The bloom produced in the mill is delivered without heating to a 30-in. bar mill consisting of three stands driven by a 3,000-hp., 375-r.p.m. induction motor.

The illustration at the bottom shows a recent installation in the Indiana Harbor plant of the Inland Steel Company in which the Kraemer system of speed control is used. The adjustable speed motor for this mill is rated at 4,500 hp., 500/300 r.p.m., and it operates a 14-in. merchant mill.

# Automatic Control of Auxiliaries

## Methods Adopted in Modern Power Stations to Keep Motors in Operation Under Adverse Conditions—Analysis of Operations and Details of New Developments—Reliability of Service a Governing Factor

By F. M. BILLHIMER
*General Engineer Westinghouse Electric & Manufacturing Company*

OWING to the fact that the modern central station is required to supply energy to its customers continuously and without interruption, considerable study and planning of systems have been found necessary by the public utility companies to meet this demand.

In addition to the many protective measures that have to be applied in the transmission and distribution system, great care is also taken in the protection of the generating equipment. This is particularly true of conditions encountered in steam generating stations as the continuous operation of the generator depends so much upon the essential station auxiliary motors such as circulating, condensate and air-pump motors for supplying the condensers and those for driving forced-draft and induced-draft fans, exciters and boiler-feed pumps.

In this article it is desired to point out briefly some of the methods which have been used in modern stations to keep motors in operation under adverse conditions and thus maintain the boilers, turbines and generators in continuous operation. Some recently developed systems of automatically controlling variable-speed alternating-current motors are also described somewhat in detail.

The single-line diagram in Fig. 1 shows an auxiliary bus arrangement in which two sources of supply are available for the station auxiliary motors. This scheme is possible where the house generator bus can be kept separate from the main bus and does not have to be paralleled with the main bus for the purpose of maintaining the proper heat balance. With this arrangement steam for heating the feed water is obtained by bleeding the main turbine.

A bus arrangement as shown in Fig. 2 illustrates a double auxiliary bus, one being fed from the main bus and the other from the house generator. The buses are, however, operated in parallel to allow the proper heat balance to be obtained, since the main turbines are not arranged for bleeding steam. With this arrangement it is, of course, necessary that the automatic opening of the tie breaker be accomplished very quickly in case of trouble on either bus.

In cases where the auxiliary buses have sufficient capacity, it is often practicable to start the squirrel-cage induction motors on full voltage, thus eliminating the use of starting buses and considerable control equipment. This method of simplifying the control equipment has been used to some extent and will likely continue to be used in many instances.

With both of these bus arangements full automatic control has been applied to squirrel-cage and wound-rotor induction motors which are used in conjunction with condensers.

Each circulating pump motor is provided with two electrically operated oil circuit breakers in order that the motor may be operated either from the house transformer bus or from the house generator bus. Relay equipment is provided for automatically transferring the motor from one bus to the other upon failure of voltage or low voltage. This is accomplished by means of an undervoltage relay which trips the breaker connected to the low-voltage bus and closes the breaker which connects the motor of the circulating pump to the other bus.

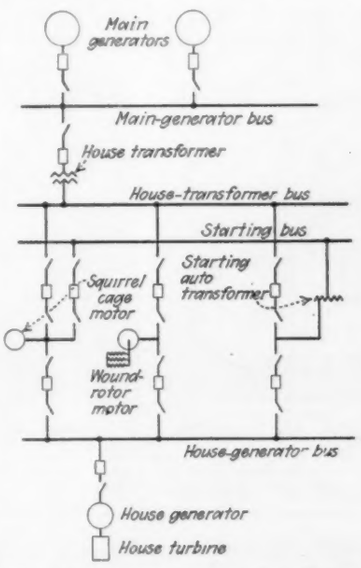



FIG. 1—TWO SOURCES OF SUPPLY ARE AVAILABLE FOR AUXILIARY MOTORS

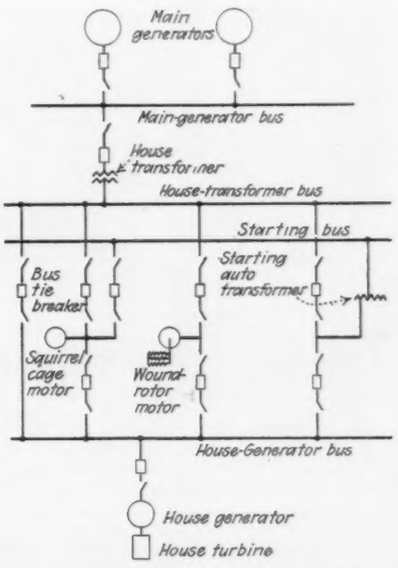



FIG. 2—DOUBLE AUXILIARY-BUS SUPPLY FOR STATION AUXILIARIES

Since the motors are of the wound-rotor type, a motor-operated cam controller is used to cut out the external starting resistance in the rotor circuit in bringing the motor up to normal speed. This controller is so interlocked with both primary breakers that the controller must be in the starting position before the primary breaker can be closed. The pilot motor for this controller is operated from a direct-current source. Fig. 3 shows a typical wall-mounted arrangement of cam controller and resistance for the secondary of a circulating-pump motor. The motor for driving the cam controller is installed just back of the hand wheel. The small controller in the cabinet is provided for operating the equipment independently of the master low-voltage relay.

The relay equipment is so arranged that if both buses should be dead or have undervoltage at the same time, the motor will not be connected to either bus. If voltage is low on one bus and the motor is transferred to the other bus, which might also have low voltage, the relay equipment will cause both breakers to remain in the open position unless voltage should return to the original bus. In this case the motor would be again connected to the original bus. A distinction is made between undervoltage and short circuit. In the case of short circuit or overload, induction-type overload relays operate to open the circuit breaker and the motor is shut down. The circuit breakers are mounted in cells and with a small panel in each cell on which are mounted the necessary timing and auxiliary relays. The overload relays are mounted on an auxiliary switchboard at another location in the power station.

### CONTROLLING SQUIRREL-CAGE CONDENSATE-PUMP MOTOR

Condensate-pump motors are usually of the squirrel-cage type and can have automatic control equipment similar to that described for the circulating-pump motors except that the cam controller and secondary resistance are not required. This cam controller is, therefore, replaced by a starting breaker, which automatically connects the motor to a half-voltage starting bus and then, when the motor is up to speed on half voltage, the starting breaker is automatically opened and the running breaker closed. The period over which the starting breaker is closed is a function of time and is predetermined by the setting of the timing relay. All of the other features for the control of the condensate-pump motors are the same as described for the circulating-pump motors.

### CONTROLLING THE STARTING TRANSFORMERS

In order that the half-voltage starting bus may be energized at all times, an automatic transfer equipment is supplied to connect these transformers to either the house transformer bus or the house generator bus. This transfer equipment operates in a manner similar to that described for the motors in that failures of voltage or low voltage will be indicated by an undervoltage relay, which connects the starting transformer to the bus having voltage suitable for starting the motors. In case of short circuit or very heavy overload on the starting transformers, both circuit breakers are locked out and the starting transformer is disconnected from both the house transformer bus and the house generator bus.

### CONTROL EQUIPMENT FOR FORCED AND INDUCED DRAFT FAN MOTORS

Some rather interesting installations of forced-draft and induced-draft fan motors and control equipment have been made. In one installation, for example, each boiler has one induced-draft fan and one forced-draft fan. The forced-draft fans are each driven by two wound-rotor induction motors, one motor being placed on each side of the fan. A magnetic clutch is supplied in order that the larger motor may be disconnected from the fan when not needed for the higher speed. Both motors are operated three-phase at 2,200 volts. The smaller motor is capable of delivering 60 hp. at 870 r.p.m., and the larger motor is capable of delivering 150 hp. at 1,160 r.p.m. This allows a speed range of 435 r.p.m. to 1,160 r.p.m., as a speed reduction in both motors is obtained by inserting resistance in the motor secondary windings. For driving the induced-draft fan a similar arangement of motors is used, but the smaller motor is capable of delivering 60 hp. at 345 r.p.m. and the larger motor is rated at 250 hp. at 575 r.p.m., thus allowing a speed range of 175 r.p.m. to 575 r.p.m.

Control equipment is provided so that the forced-draft or induced-draft fans may be controlled individually by hand from separate push-buttons. All forced-draft and induced-draft fans for all boilers in the stations may also be operated as a unit from a master push-button. The control equipment has been arranged so that at a later date all fans may be controlled by means of a steam-pressure regulator or part of the fans may at any time be taken from the control of the regulator and controlled by hand, while the regulator is still controlling the remaining fans.

Control equipment for each two-motor fan equipment consists of a primary control panel and a motor-operated cam controller. A master panel is supplied for use with both the forced-draft and the induced-draft fan equipment.

Automatic control is obtained through the use of a regulator which is mechanically coupled to a "transmitter indicator" motor through a cable. This motor, which is similar to the smaller motor on the head of the cam controller, has a single-phase stator and a three-

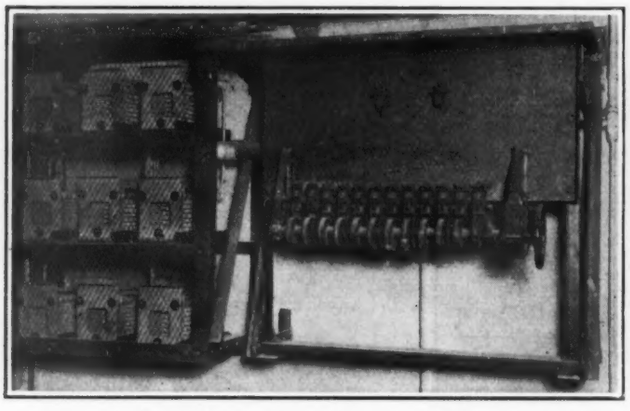


FIG. 3—AUTOMATIC CONTROL EQUIPMENT FOR WOUND-ROTOR CIRCULATING-PUMP MOTOR

Starting at left the devices shown in Fig. 4 are the forced-draft primary control panel, cam controller for resistance in motor-

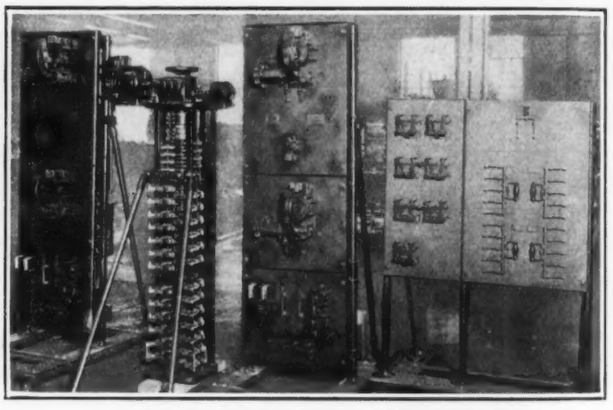


FIG. 4—CONTROL EQUIPMENT FOR A TWO-MOTOR DRAFT-FAN EQUIPMENT

rotor circuit, induced-draft fan motor, primary control panel and master panel.

phase rotor. The position of the rotor of this "transmitter indicator" determines the position of the "receiver indicator" motor, which is the smaller motor shown on the head of the cam controller. The "receiver indicator" motor is connected through planetary gears to a master drum inside the controller. The "transmitter-indicator" and "receiver-indicator" motors are excited from the same 110-volt alternating-current circuit. With both stators excited currents are set up in the rotor circuit of the two motors, which rotate them into similar positions with respect to their poles. This "transmitter-indicator" motor is held in definite position by the regulator, and the "receiver-indicator" motor must take a position to correspond to the position of the "transmitter-indicator" motor. The master drum, being geared to the "receiver-indicator" motor, takes a position dependent on the relative positions of the controller cam shafts and the "receiver-indicator" motor.

When the cam controller is in the position in which the regulator (through the indicator and pilot motor) is trying to place it, the master drum is in the neutral position and has its contacts open. If, however, the regulator shows an increased steam demand, the master drum closes contact, which starts the pilot motor in the fast direction, and the cam controller is notched to a faster position until the master drum is brought back to the neutral position by this movement.

Interlocking is provided to prevent starting the forced-draft fan until the induced-draft fan is running. If, for any reason, the motor primary contactors on the induced-draft fan open or the clutch excitation fails, the forced-draft fan motor is automatically shut down. In obtaining the entire range in speed the lower speeds are obtained by allowing the smaller motor to be brought up to its full speed. A magnetic contactor then connects the large motor, and, after the clutch has operated, the primary of the small motor is disconnected from the line. The magnetic clutch is operated from a direct-current circuit. In many installations the magnetic clutch is omitted, thus allowing the rotor of the larger motor to be connected to the small motor shaft at all times.

Fuses are so located that should trouble arise in the control wiring it will be confined as much as possible to one unit. One forced-draft and one induced-draft fan-motor control are considered as one unit.

### CONTROLLING BOILER-FEED PUMP MOTOR

This equipment, which is used for the control of a high-speed wound-rotor induction motor, is arranged for automatically maintaining a constant excess pressure in the feed line over the boiler pressure by means of an excess-pressure regulator.

A solenoid-operated oil circuit breaker is used for the primary of the induction motor, and two cam controllers are used for adjusting the resistance in the secondary of the motor. One of these controllers is hand-operated and is used for the starting operation, while the other controller is motor-operated by means of a direct-current pilot motor, which is used for adjusting the regulating resistance (Fig. 6).

In starting, the primary breaker is closed. The hand-operated cam controller is then used to short-circuit the starting resistance in the secondary of the motor to bring it up to the minimum speed for automatic regulation. After this has been done speed regulation is under the control of the regulator. The regulator operates upon the motor-operated cam controller through a set of gears outside the cam controller. This connection is completed inside the controller through planetary gears to a master drum inside the controller. The master drum, being geared to the regulator, takes a position dependent on the relative position of the controller cam shaft and the regulator.

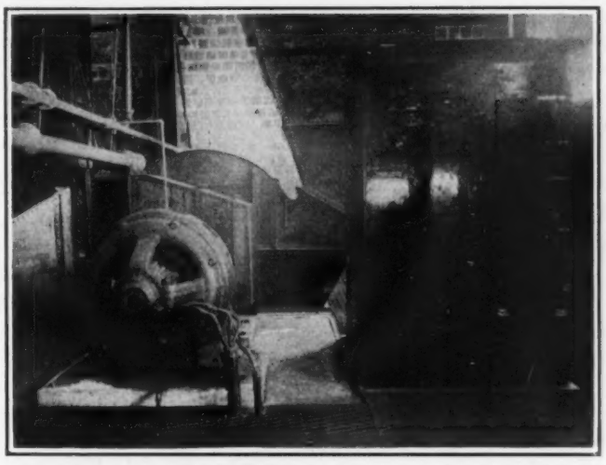


FIG. 5—A TYPICAL INSTALLATION OF A TWO-MOTOR INDUCED-DRAFT FAN EQUIPMENT

The induced fan is driven by two motors, and the illustration shows the fan and the larger motor of the equipment and the complete control equipment for the two motors.

When the cam controller is in the position where the regulator is trying to place it, the master drum is in the neutral position and has its contacts open. If, however, the regulator shows that an increased pressure is required, the master drum closes its contacts, which starts the pilot motor in the fast direction, and the cam controller is notched to a faster position until the master drum is brought back to the neutral position by this movement. Interlocking is provided so that the primary breaker cannot be closed until the hand-operated or starting controller is in the "off" or "starting" position. Any or all of the regulating resistance may be short-circuited when the primary breaker is closed. Sixteen points are provided on the

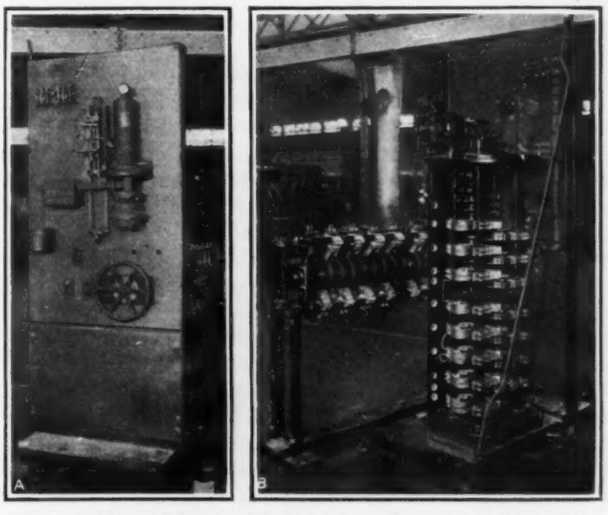


FIG. 6—FRONT AND REAR VIEWS OF BOILER-FEED PUMP CONTROL

Control equipment for a 500-hp., 2,200-volt motor: (a) The excess-pressure regulator and the hand wheel for the starting controller; (b) the horizontal cam controller, used for starting, and the vertical motor-operated controller, used for adjusting the regulating resistance.

starting controller and fifteen points are provided on the automatic regulating controller. In case it is desired to reduce the speed below that available with automatic regulation, six points on the hand-operated cam controller may be used for this purpose.

### EXCITATION FOR MAIN GENERATOR

As a means of preserving excitation for main generators dual-drive exciter sets have been used. With this scheme a direct-current generator is supplied with

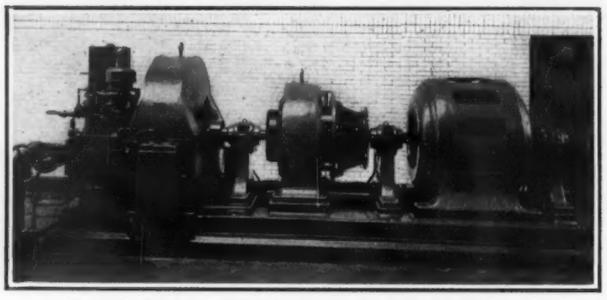


FIG. 7—A DUAL-DRIVE EXCITER SET USING A WOUND-ROTOR MOTOR

a driving motor and a steam turbine. The turbine is equipped with a governor, which permits the turbine to carry the load of the exciter in case voltage fails on the alternating-current driving motor. Fig. 7 shows such an exciter set in which a wound-rotor induction motor is used. A squirrel-cage motor may be used, although in large sizes, where heavy starting current is objectionable for a house generator bus, the wound-rotor motor is preferred. With this motor automatic secondary resistance short-circuiting contactors are used. The closing of these contactors is controlled by accelerating relays and occurs as soon as the motor primary breaker has been closed.

Upon failure of the motor supply voltage, the primary breaker remains closed, but the resistance short-circuiting contactors open and insert the full starting resistance. The steam turbine then carries the load. Upon voltage being restored, the secondary contactors automatically short-circuit the motor secondary resistance and the motor then carries the load, the turbine governor automatically shutting off the supply of steam.

In installations using motor-driven exciters without the dual-drive feature similar control equipment for the motor secondary can be supplied. In some cases where two auxiliary buses are available for supplying the motor additional protection to prevent the loss of excitation is provided by supplying two electrically operated primary breakers for each motor. These breakers are properly interlocked and allow the motor to be connected to either of two sources of supply.

The method of transferring the motor from a faulty bus to another source of supply is as explained above for transferring the primary of the circulating-pump motor.

# Push Self-Starting Motors

## Why Central Stations Should Be Interested—Reason for Active Sales Effort —Eliminate Waste and Reduce Costs—Good Torque and Power Factor Characteristics

By J. C. HOBART
*President Triumph Electric Company, Cincinnati, Ohio*

IT IS perhaps well first to make certain that we have the same understanding of the name "self-start." It is generally recognized, through years of practical experience, that there are serious objections to starting any type of electric motor larger than 5 hp. by connecting it directly across the main supply lines without the intervention of some type of control device designed to limit the initial flow of current necessary to start the motor and its connected load. These devices perform the function of holding the current at start within prescribed limits either by introducing temporary resistance in the motor circuit or by temporarily reducing the voltage applied at the motor terminals.

Since the torque exerted by the motor is proportional to the square of the applied voltage, it is readily seen that the latter method of controlling the initial flow of current results in a great reduction of the power the motor is able to exert at the very instant it is most needed, namely, in starting its load. Since squirrel-cage induction motors require this type (voltage reduction) of control, central stations have been compelled to insist upon the installation of slip-ring motors for applications requiring any considerable starting duty, although this requirement entails a much larger initial investment on the part of their customers.

To meet these conditions manufacturers have developed, in the interest of both the central station and its customer, a line of internal-resistance induction motors that have been variously called "self-start," "automatic start" and "starterless." All of these introduce resistance in the construction of the secondary circuit, which is automatically short-circuited at a predetermined speed, and thus eliminate the necessity of any external control device.

### COMPENSATORS AN ABSURDITY

In the "Story of the Induction Motor" the late B. G. Lamme, one of the leading engineers of his time and one who contributed more, perhaps, than any one else to the commercial development of the induction motor, says: "The compensator method of starting [induction motors] includes a palpable absurdity in that it introduces in a design having intrinsically low torque a device for lessening that torque at start." It is generally recognized that this "palpable absurdity" has been responsible for the common practice of overmotoring, or, in other words, the practice of installing a motor larger than the full-speed requirements of the application in order to insure prompt start and "pick up" of the load.

A leading executive in the central-station field is authority for the statement that central-station records

show that 80 per cent of the motors on their lines never reach one-half the load rated on their nameplates. It is only in exceptional cases that the duty cycle of a motor is accurately known, and the natural tendency is to "play safe" by recommending a motor a little larger rather than one too small to take care of any emergency. Since this is true, the above statement by the central-station executive may be regarded as conservative.

### PREVENTABLE LOSSES

How does this situation affect the central-station company or its customers? What benefits could be expected to accrue to both if induction motors on central-station lines were installed on the basis of the customers' actual full-load requirements? The number of variables to be taken into consideration is too great to permit an accurate answer to this question, but it can be readily shown that the losses entailed by present conditions are great and could in a large part be prevented.

The difference between the power factor of an induction motor operated at half load and that of the same motor operated at full load is at least 25 per cent. It follows, therefore, that if the motors on their lines are operated at only half load, central stations must have generator capacity one-third greater than would be necessary were the installed motors of the size proper for running at full load. Furthermore, under these conditions they are supplying one-third of their output in wattless current that does not register on customers' meters.

In an analysis of the distribution in the United States of electrical energy for the year 1923, the ELECTRICAL WORLD credits 20,000,000,000 kw.-hr. to industrial power requirements. It may be assumed that 2,400 hours, representing 300 days of eight hours each, is the yearly demand. This means that 8,000,000 kw. must be generated, and that if only 80 per cent of the motors on the line reach half load or better, central stations must maintain 10,600,000 kw., which represents an excess investment of 2,600,000 kw. Allowing only $100 per kilowatt installed, this excess investment amounts to $260,000,000. The interest and depreciation charges on this large sum must be added to the rate charged the consumer, as must also the cost of generating 2,600,000 kw. This latter figure amounts to 6,240,000,000 kw.-hr. per year at an approximate cost of 2 cents per kilowatt-hour, which totals $124,800,000.

### LARGE MONEY LOSS INVOLVED

When it is remembered that the central stations of this country are expending at a rate of $1,000,000,000 per year and have laid plans for the next ten years at that rate, the above figures lose some of their impressiveness. They are, nevertheless, of such proportions as to make clearly evident an extremely large loss that is going on all the time and at a constantly increasing rate as the use of electrical energy for industrial purposes increases. Such losses are a heavy handicap for the industry to carry, and their elimination will benefit both the central station and the power users. The central station will be benefited by a large reduction in cost of financing, now necessary for nonproductive investment, and the ability to produce more revenue-bearing energy from the same generating capacity. Users will benefit by reduced investment per unit of power installed and by lower operating costs due to the lower rates which the central-station company could afford to make.

The investigation by the Hoover committee on the elimination of waste in industry clearly indicated that the advancement of future civilization demands the elimination of all preventable waste. The wastes we are discussing are to a very great extent preventable. Statisticians have demonstrated that the standards of living are highest in those countries producing the greatest amount of horsepower per capita of their population. They are lowest in China, highest in the United States, and in no other country is there available, still undeveloped, a greater source of power supply. To maintain our present high level of living, despite increases in population, and to continue to maintain it above all other countries, power must be supplied in increasing amounts and at reduced cost to the user.

### CHARACTERISTICS OF GOOD SELF-STARTING MOTOR

A good self-starting motor may be installed, rated on the basis of full-speed requirements, so that, when running, it will operate at its full load or most effective point and yet be guaranteed to start without drawing from the line a greater amount of current than would a larger motor started by reduced voltage through a compensator. Even where slip-ring motors are specified to hold down the starting current, the desired results depend on the care and skill of the operator, instead of depending on automatic control, as in the case of the self-starting motor.

The situation is paralleled by that of the metal-filament lamp, the introduction of which increased greatly the lighting load and at the same time reduced the cost of lighting to a point where a vastly increased number can enjoy its benefits. Test after test by leading engineers has demonstrated that the self-starting motor, when installed in the size proper for running at full rated load, could and would supply at start three times the torque required for full-speed running of the motor.

This characteristic alone offers effective remedies to the abuses under discussion. Manifestly, if the starting load requirements may be disregarded, the problem is greatly simplified. Motors may be applied so precisely that overmotoring and undermotoring are precluded even to the user having but slight knowledge and limited experience in such matters.

Full-speed efficiency and power factor are assured. Simplification of the starting system reduces the inductive losses inherent in ordinary methods of starting induction motors. High power factor at start contributes further to the elimination of the wattless current now being unnecessarily supplied by central stations and paid for by the user in the form of a premium on his monthly energy charges.

It therefore appears that the self-starting motor by eliminating the compensator method of starting, and because it develops a high starting torque accompanied by high power factor at start, offers new standards of economy in the application, use and upkeep of induction motors. Not the least of these are the savings in capital investment for motor horsepower made possible to the user and the opportunity of the central-station company to limit its investments to a figure more in keeping with the actual kilowatt-hour consumption of the apparatus on its lines.

# Method of Calculating Rural Extensions

## Policy of the Adirondack Power & Light Corporation in Which Customers May Make Deposits to Help Finance Extensions and Pay Minimum Bills or Make No Deposit but Increase Minimum

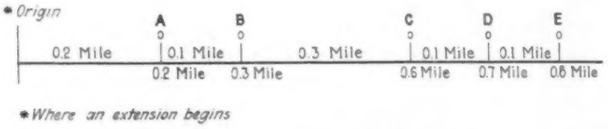
By CHARLES H. CHURCHILL, JR.
*Rural Extension and Farm Service Division,*
*Adirondack Power & Light Corporation, Schenectady, N. Y.*

THE Adirondack Power & Light Corporation now operates approximately 150 miles of rural lines, from which about 1,500 rural customers are served. Some of these customers are suburban residents, others farmers and still others residents of small villages or hamlets. At present a detailed survey is being made to ascertain the exact number of miles of line now being operated and the number, in the various classes, of customers being served therefrom.

During the past year or two the demands for rural extensions have been considerable and it was decided that a broad, comprehensive method of handling these extensions was needed.

In working out a program for rural extensions the matter of an extension policy or a code of extension rules was considered first rather than types of line construction, since, in consideration of the nature of farm operations in this part of the state and the relative density of distribution centers, it was concluded that, in general, this field could be served with single-phase extensions of relatively low primary voltage. Moreover, after giving the matter considerable thought and study, it was agreed that these extensions could be built for an average cost over the entire territory of not more than $1,600 per mile. Having determined this point, it remained to determine ways and means of financing and paying the fixed and operating costs on such extensions.

In many cases the company will make the entire investment in the line extension. In other cases the customers will make cash deposits toward the cost of part or all of the extension. On the money invested




APPLICATION OF CUSTOMER INDEX

by the company there should be earned annually 8 per cent return and another 8 per cent to cover the cost of taxes, depreciation, extraordinary hazard, etc., or a total of 16 per cent. Where the money for building the line is advanced by the applicant, only the 8 per cent to cover the cost of taxes, depreciation, etc., need be earned.

Thus it has been concluded that 16 per cent annually must be earned on the money invested by the company, plus 8 per cent on that deposited by the customer. It is proposed to meet these costs through the medium of minimum monthly revenue. That is to say, instead of requiring the customer to pay a fixed charge plus an energy charge, it was decided to hold him to a minimum monthly bill which would be high enough to net the company the required revenue.

Let:

$SI_1$ = company investment in system extension per customer,
$SI_2$ = customer's deposit toward system extension per customer,
$SI = SI_1 + SI_2$,
$AFC$ = annual fixed costs,
$= 16\%\ SI_1 + 8\%\ SI_2$,
$MFC$ = monthly fixed costs,
$= AFC \times \frac{1}{12}$.

If the average rate charged for energy is 9 cents per kilowatt-hour and the average increment production cost of energy is 1 cent per kilowatt-hour, then there is 8 cents per kilowatt-hour available to meet these costs. Thus, if $MFC$ is divided by 8 cents, the necessary kilowatt-hours to be sold is obtained, and if these kilowatt-hours are multiplied by 9 cents the necessary revenue to meet the fixed costs is obtained. This may be expressed as

$MMB$ = minimum monthly bill,
$= (16\%\ SI_1 + 8\%\ SI_2)9/8 \times \frac{1}{12}$,
$= 0.015\ SI_1 + 0.0075\ SI_2$.

That is to say, an extension will be made for any customer who will pay the minimum monthly bill and make a deposit in accordance with this formula. Thus, if a given extension costs $600 and the customer is willing to deposit $200 toward the cost of the extension, his minimum monthly bill shall be:

$$MMB = 0.015 \times \$400 + 0.0075 \times \$200.$$

If the customer makes no deposit, $SI_2$ becomes zero and the formula is simply:

$$MMB = 0.015\ SI.$$

Since this formula is based on the assumed average cost of $1,600 per mile, the minimum monthly bill or deposit necessary for any customer can be computed on the basis of the number of miles of extension necessary to serve him.

By dividing $1,600 by various numbers of customers per mile a series of minimum monthly bills and of customer's deposits have been computed. These are shown in Table I. It is shown in the table that where there is, say, an average of five customers per mile, each customer has his option of having a minimum bill of $4.80 and making no deposit, or a minimum bill of $4 and a deposit of $107, or a minimum bill of $3 and a deposit of $240.

For the purpose of applying these rules the term "customer index" has been coined, which is simply the reciprocal of customers per mile. Thus a customer who requires an extension of 0.125 mile is at the rate of

8 per mile and his index is said to be 0.125 mile. This is shown graphically in the diagram on page 556.

*Case I.* Suppose farmer A requests an extension from the origin to his farm. The necessary length of extension will be 0.2 mile. Let this number be called the customer's exact index.

*Case II.* After A has helped finance an extension from the origin to his farm, B comes around and wants an additional extension of 0.1 mile to serve him. It is unfair to A to let B benefit disproportionately from A's extension, so while B's exact index is 0.1 mile, when he and A are averaged they each have relative indices of 0.3 ÷ 2, or 0.15 mile. Thus B shares the burden with A since he benefits by A's extension.

*Case III.* If now C applies for an extension, he will have an exact index of 0.3 mile and A, B and C will have relative indices of 0.6 ÷ 3 or 0.2 mile. This would raise the present index of 0.15 mile which A and B now have, but since they benefit in no wise by C's extension they should not be made to share it with him and the terms of C's extension are then based on his exact index of 0.3 mile. The end of B's extension might then be called sub-origin No. 1, because it is there where C's exact index starts.

*Case IV.* Suppose now farmer D 0.1 mile beyond C requests an extension. His exact index is 0.1 mile, his relative index to sub-origin No. 1 is 0.2 mile, and his relative index to the origin is 0.7 ÷ 4, or 0.175 mile. To average him away back to the origin will not lower A's and B's index, but to average him with C will lower C's, therefore C and D will have relative indices of 0.2 mile, while A and B will still have indices of 0.15 mile.

In short, the principle is this: A new customer will be averaged in with one or more other present customers on the line when by so doing their indices remain the same or are lowered. In no case will a new customer raise the index of a present customer.

Customers between points of origin (i.e., sub-origin No. 1 and sub-origin No. 2, etc.) will have the same index.

Customers may come on and off the line during the year, and on December 31 of each year the correct indices for all existing rural customers shall be determined. The exact or relative index shall be used, whichever applies, and then from the table the minimum bills and deposits applying to that customer can be determined.

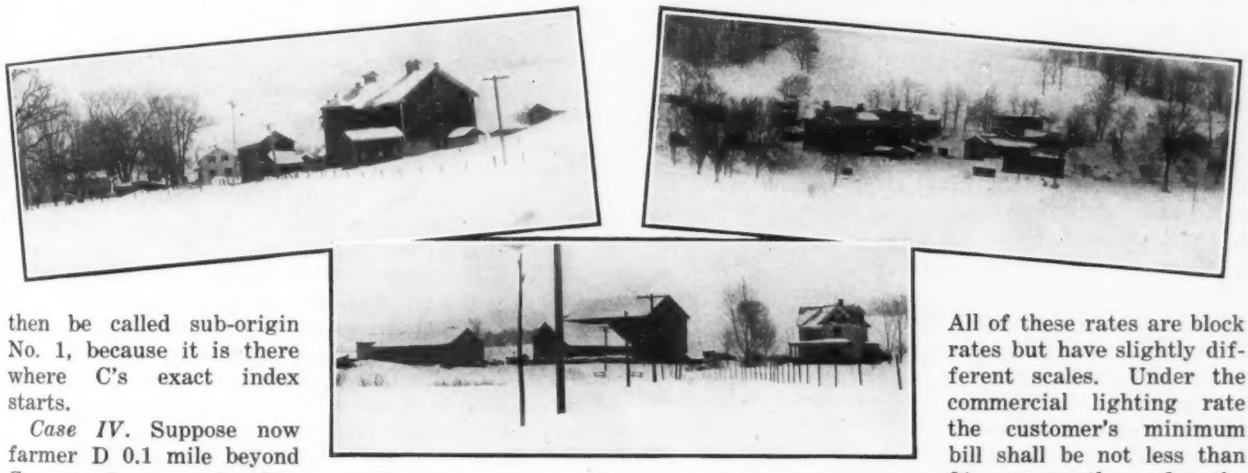
The table shows that if a customer has an index of 0.125 or less, his minimum monthly bill shall be not less than $3 and he shall be required to make no cash deposit. However, if his index is greater than 0.125, he may make a deposit at his option as shown by the table.

Any deposit made by a customer is subject to refund within four years, as follows:

1. If additional customers come on the line, lowering this customer's index, on the December 31 next succeeding this customer's correct index shall be computed and his deposit shall be partly or wholly refunded to him, depending upon whether or not his new index requires a deposit.

2. If after first taking service the customer decides he is willing to have a higher monthly bill, he selects a certain bill from the table and the appropriate refund is made on his deposit.

Under the present application of these rules the rates in general for service in rural territory are the same as those applying in the urban center from which the extension originates. Thus a farmer might have one or more meters, depending upon the number of classes of service he used. There is, for instance, one rate for commercial lighting, another rate for domestic heating and refrigeration and another rate for retail power.



THREE FARMS SERVED BY ADIRONDACK POWER & LIGHT CORPORATION. MONTHLY BILLS AVERAGE $8, $16 AND $7.50

All of these rates are block rates but have slightly different scales. Under the commercial lighting rate the customer's minimum bill shall be not less than $1 per month, under the retail power rate $1 per horsepower but not less than $3, and for domestic heating and refrigeration 40 cents per kilowatt but not less than $3 per month. Thus a customer's index referred to the table gives a certain minimum monthly bill and the sum of the customer's monthly bills on his various meters shall not be less than the minimum as given by the table.

A typical form for keeping a record of customer's deposit is given in Table II with some typical cases worked out illustrating this application.

Reference was made above to the average rate for energy being 9 cents per kilowatt-hour. This was determined from the special block rate for farm service or farm service classification, which was designed along with the method for making extensions. This rate is now in use in only one of the company's districts, but will ultimately be used throughout its territory. It provides for each customer's entire use of service being taken through one meter.

This method for making rural extensions has been approved by the New York State Public Service Commission and has been in operation several months. Thus far it has proved to be very adaptive and very satisfactory to farm customers. Several farmers who heretofore seemed economically out of reach have signed up for a minimum bill of ten, twelve or sixteen dollars per

TABLE I—OPTIONAL MINIMUM BILLS AND CUSTOMERS' DEPOSITS DEPENDING ON CUSTOMER DENSITY

| Customer Index (Miles) | Customers per Mile | Minimum Monthly Bill | Customer's Deposit | Customer Index (Miles) | Customers per Mile | Minimum Monthly Bill | Customer's Deposit |
|---|---|---|---|---|---|---|---|
| 0.125 | 8 | $3.00 | $0.00 | 0.286 | 3.5 | 6.85 | 0.00 |
| | | | | | | 6.00 | 113.00 |
| 0.143 | 7 | 3.43 | 0.00 | | | 5.00 | 247.00 |
| | | 3.00 | 59.00 | | | 4.00 | 380.00 |
| 0.167 | 6 | 4.00 | 0.00 | | | 3.43 | 457.00 |
| | | 3.00 | 133.00 | | | | |
| 0.182 | 5.5 | 4.36 | 0.00 | 0.334 | 3 | 8.00 | 0.00 |
| | | 4.00 | 50.00 | | | 7.00 | 133.00 |
| | | 3.00 | 183.00 | | | 6.00 | 267.00 |
| 0.200 | 5 | 4.80 | 0.00 | | | 5.00 | 400.00 |
| | | 4.00 | 107.00 | | | 4.00 | 533.00 |
| | | 3.00 | 240.00 | 0.400 | 2.5 | 9.60 | 0.00 |
| 0.222 | 4.5 | 5.33 | 0.00 | | | 8.00 | 213.00 |
| | | 5.00 | 45.00 | | | 7.00 | 347.00 |
| | | 4.00 | 179.00 | | | 6.00 | 480.00 |
| | | 3.00 | 312.00 | | | 4.80 | 640.00 |
| 0.250 | 4 | 6.00 | 0.00 | 0.500 | 2 | 12.00 | 0.00 |
| | | 5.00 | 133.00 | | | 10.00 | 267.00 |
| | | 4.00 | 267.00 | | | 8.00 | 534.00 |
| | | 3.00 | 400.00 | | | 6.00 | 800.00 |

month and are now being served. On many existing lines whereon a minimum of three or four dollars applies, the customer's average use is about six or eight dollars per month, thus supplying additional revenue with which to meet commercial and other expenses.

The plan outlined above makes tools available with which to go ahead with the general extension of service to farm customers, and it is the function of the newly organized rural extension and farm service division of the Adirondack Power & Light Corporation's commercial department to promote the adaptation of this service to more and more farm purposes. Numerous experiments and demonstrations with portable power outfits are now being conducted, and extensive plans have been made for general rural electrification.

TABLE II—FORM FOR KEEPING RECORD OF CUSTOMER'S DEPOSIT

Name.....Account No.....

Address.....System Extension.....

| Date | Remarks | Customer Index | Minimum Monthly Bill Table | Service Classification 1 | 4 | 5 | Deposits | Refund | Balance |
|---|---|---|---|---|---|---|---|---|---|
| Case I. | | | | | | | | | |
| 6/23 | | 0.25 | 4.00 | 4 | .. | .. | $267 | .... | $267 |
| 12/23 | Class No. 4..... | 0.25 | 6.00 | 3 | 3 | .. | .... | $267 | 0 |
| Case II. | | | | | | | | | |
| 6/23 | | 0.20 | 4.00 | 4 | .. | .. | 107 | .... | 107 |
| 12/23 | Class Nos. 4 and 5 | 0.20 | 4.80 | 1 | 3 | 3 | .... | 107 | 0 |
| Case III. | | | | | | | | | |
| 6/23 | | 0.25 | 4.00 | 4 | .. | .. | 267 | .... | 267 |
| 7/23 | | 0.25 | 4.00 | 1 | 3 | .. | .... | .... | 267 |
| 12/23 | | 0.20 | 4.00 | 1 | 3 | .. | .... | 160 | 107 |
| 12/24 | | 0.20 | 4.00 | 1 | 3 | .. | .... | .... | 107 |
| 12/25 | | 0.20 | 4.00 | 1 | 3 | .. | .... | .... | 107 |
| 12/26 | | 0.20 | 4.00 | 1 | 3 | .. | .... | .... | 107 |
| 12/27 | | 0.20 | 4.00 | 1 | 3 | .. | .... | 107 | 0 |

* Balance transferred to contributed property.

Three typical cases are illustrated:

*Case I.* The customer has an index of 0.25 mile, and since he does not want to pay more that $4 per month, he must deposit $267 as given by table. The following month he applies for service under classification No. 4 in addition to classification No. 1. According to his connected load his minimum on classification No. 4 is $3 and, since he found he was already using about $3 per month on his lighting, he chose to have a $6 minimum and a refund of his deposit. This refund should be made December 31 of that year.

*Case II.* The customer has an index of 0.20 mile and elects a $4 minimum monthly bill with a deposit of $107. The following month he takes two more service classifications, giving him a total minimum monthly bill of $7. Since this is greater than $4.80, as specified by the table, on December 31 of that year his deposit is refunded to him.

*Case III.* This starts off similar to Case I. The next month the customer takes service under classification No. 4 with a minimum monthly bill of $3 on classification No. 4 and $1 on classification No. 1 as specified by the classifications. On December 31 of that year it is found that other customers have come on, lowering his index to 0.20 mile. On this basis he is refunded $160. At the end of the fourth year no further change has occurred, and the balance of $107 is transferred on the company's books to contributed property.

## Large New Research Laboratories in England

IMPORTANT new research laboratories were not long ago opened at the works of W. T. Henley's Telegraph Works Company at Gravesend, England. One purpose which the laboratories have been designed to serve is that of testing the quality of the raw materials used in the manufacture of the concern's products, such as oil, rubber, lead, copper, paper, etc., and also of investigating new materials. Another important function is to try out factory processes under exactly controlled conditions on a scale sufficiently large to permit a judgment to be formed of their applicability to full-scale manufacture. There is also a department whose business it is to compile technical information from published data and from results obtained in the laboratories and to answer the numerous inquiries on technical points received from customers all over the world.

The laboratories are housed in a building of brick and steel, having a total floor area of 14,000 sq.ft. The first floor contains a chemical laboratory, library and administrative offices, while on the ground floor are a workshop, room for physical tests, furnace room, room for microscopic and microphotographic investigations and high-tension and low-tension laboratories. The rooms are provided with supplies of town water, town gas, steam at 60 lb. and compressed air at 15 lb., and vacuum and pressure pumps are installed with special connections. Electrical power is available in the form of 440 volts, three-phase, and 110 volts, 250 volts and 500 volts direct current, and by means of a 110-volt storage battery of 800 amp.-hr. capacity any voltage between 2 and 110 can be connected to any room.

The largest of the laboratories is devoted to high-tension work. It is equipped with the most modern plant for the measurement of dielectric losses and for the application of high-voltage tests to finished lengths of cable. A 225-kva., three-phase, 500-volt motor-generator operating through three regulating transformers supplies the primaries of three 500/125,000-volt, single-phase testing transformers, and, as the latter are each insulated for 250,000 volts to earth, a three-phase test up to 210,000 volts or single-phase up to 375,000 volts can be effected by suitable grouping. Two heat-lagged water tanks 8 ft. deep enable tests to be made on drum lengths of cable at temperatures up to 90 deg. C. The low-tension laboratory is equipped with special apparatus evolved for testing impregnating compounds for dielectric resistance, breakdown and viscosity. A convenient method—suggested by the United States Bureau of Standards—is employed for ascertaining the conductivity of copper. It does not require the actual dimensions of the copper rods to be exactly known and depends on measurement of the temperature coefficient, from which the conductivity is deduced.

Two interesting machines in the physical testing room are a Schopper machine, for testing the tensile strength of twine, rubber, cotton and fine wire, and a tearing tester, which is being employed to determine whether a tearing test is a better criterion of the qualities of a cable paper than tensile strength.

Upon the opening day of these laboratories experiments were made with 500,000 volts. Finished lengths of cable, insulators and other items were tested to see how far they could withstand pressure as high as 300,000 volts.

# The Place of the Holding Company

By George N. Tidd
*President American Gas & Electric Company*

GEORGE N. TIDD

HOLDING companies financing and operating large interconnected light and power systems have come to play a most important part in the structure of the electrical industry, and it is interesting to consider the reasons for their steady growth. They have been so maligned by agitators and the uninformed that the mere fact of their survival shows there is a real need for them; otherwise some organization less sure to be criticised would have been substituted.

Some of the reasons for their being may be briefly summarized in this way:

1. Financially they are comparable in their relation to the electrical industry to the Federal Reserve banks in their relation to the banking system.

2. They bring to the smallest community the same type of service offered to the largest cities and in doing this are very important factors in the development of the territory they serve.

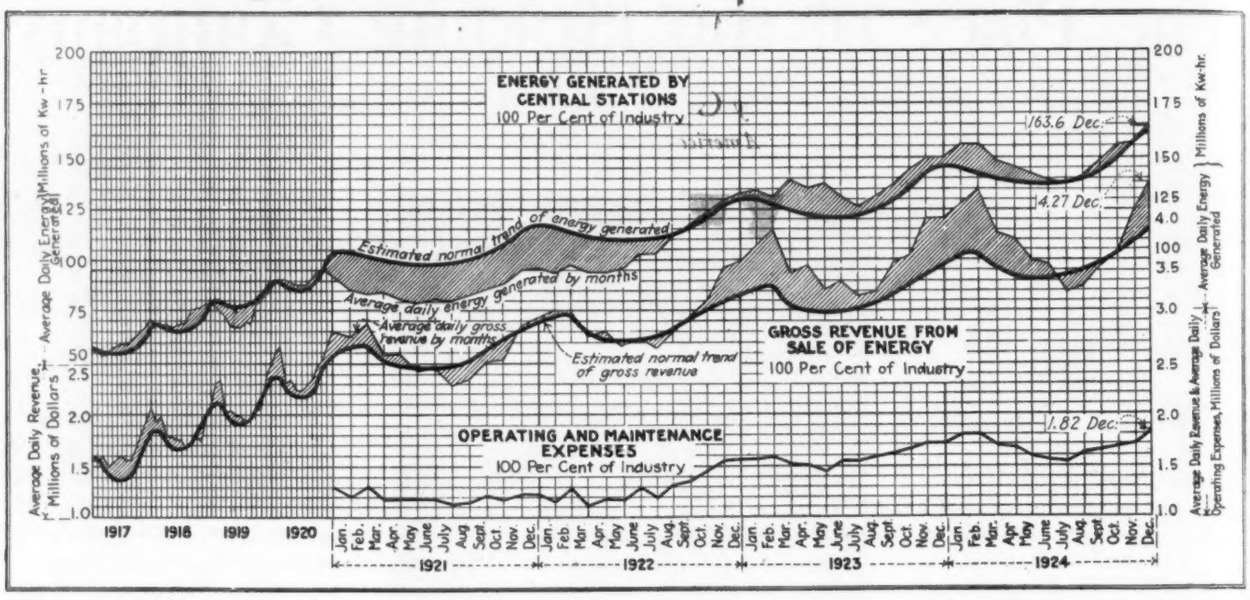
3. They give improved service at a lower cost than is possible with the small isolated plant, with its usually small capacity and output, and make available capacities which would be utterly unavailable with the small isolated plant.

The Federal Reserve has served as a stabilizer to the United States banking system, has provided a reservoir of credit which is available over all the country and has also furnished an invaluable service in the development of the country. The holding company in the public utility field serves quite the same function from a financial standpoint, and where the generating plants are interconnected physically they likewise provide a reservoir of generating capacity closely resembling the financial reservoir. These companies are, furthermore, developed along the most progressive lines and under the direction of highly trained executives and engineers, and they weld the various parts into a smoothly operating and closely co-ordinated system, which is able to furnish power in large quantities at the points where it is needed. Owing to this fact, they offer the smaller communities better service than they could ever hope to have from a local plant, and it is obvious that large industries can consider establishing plants in small towns, where in many instances the living conditions are much better than in the larger towns, if they have an ample amount of power available and are not dependent upon the small isolated and insufficient local plant. The holding companies open in this way an avenue of progressive future growth in every small community to which they extend service.

Because such companies can manufacture their power in larger blocks in the most efficient plants, located in relation to coal and water at the most favorable points for economic generation, they can offer surer and better service to their customers at much lower rates. This is an inherent virtue of a system large enough to finance the building and interconnecting of a few large steam and hydroelectric plants in which a kilowatt of electricity can be generated at much less than the cost required in a smaller plant.

The holding company structure seems somewhat complicated to the public, but every step has been necessary because of the rapid growth of the electrical industry and has been made only if it serves the ends of increased economy and efficiency. It places a premium upon administration, management and service to the public.

# Output Passes Five Billion Mark in December




OPERATIONS in the central-station industry took a decided upward swing in December after the unexpected slump in November. Increased electrical consumption by power customers was especially noticeable, the consumption for power purposes being 12 per cent above December of 1923. The total consumption during the month was 5,071,595,000 kw.-hr., which is the first time in the history of the industry that the monthly output has passed the five billion mark.

The industry was operating very close to the estimated normal during December in so far as the generation of energy was concerned. The revenue, however, was about 11.7 per cent above the estimated normal. The operating ratio of companies having steam plants averaged only 45.8 per cent during the month, which is the lowest operating ratio recorded since January, 1922, when the same percentage was reported. There is every indication that the operating ratio for January, 1925, set a new low record for the industry.

TABLE III—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL POWER PLANTS IN THE UNITED STATES*
(100 per Cent of the Industry)

| Month | Energy Generated | | | | Fuel Consumption | | |
|---|---|---|---|---|---|---|---|
| | Hydro Plants | | Fuel Power Plants | | | | |
| | Thousands of Kw.-Hr. | Per Cent | Thousands of Kw.-Hr. | Per Cent | Coal (Short Tons) | Oil (Barrels) | Gas (Thousands of Cubic Feet) |
| October..... | 1,598,883 | 33.0 | 3,217,990 | 67.0 | 2,820,610 | 1,362,166 | 6,045,769 |
| November... | 1,534,877 | 32.8 | 3,141,984 | 67.2 | 2,891,972 | 1,110,948 | 4,536,881 |
| December... | 1,710,304 | 33.7 | 3,361,291 | 66.3 | 3,141,299 | 1,306,466 | 2,917,227 |

* As collected by United States Geological Survey. The data are for the electric light and power industry only.

TABLE I—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 per Cent of the Industry)

| Month | Kw.-Hr. Generated Monthly | | | Distribution of Energy Generated | | | | | | | | | | Energy Purchased by Public Utilities for Resale, Kw.-Hr. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Total Energy Consumption by Central-Station Customers, Kw.-Hr. | | Energy Consumed for Lighting, Kw.-Hr. | | Energy Consumed for Power, Kw.-Hr. | | Energy Sold to Electric Railways, Kw.-Hr. | | Energy Used in Intracompany Business Including Line Losses, Kw.-Hr. | | | |
| | 1924 Thousands | 1923 Thousands | Per Cent Inc. | 1924 Thousands | 1923 Thousands | 1924 Thousands | 1923 Thousands | 1924 Thousands | 1923 Thousands | 1924 Thousands | 1923 Thousands | 1924 Thousands | 1923 Thousands | 1924 Thousands | 1923 Thousands |
| October..... | *4,816,873 | 4,575,007 | 5.2 | 3,887,873 | 3,692,007 | 1,118,000 | 970,000 | 2,222,873 | 2,207,007 | 547,000 | 515,000 | 929,000 | 883,000 | 777,500 | 638,000 |
| November... | *4,676,861 | 4,485,208 | 4.3 | 3,773,861 | 3,624,208 | 1,150,000 | 998,500 | 2,093,861 | 2,127,708 | 530,000 | 498,000 | 903,000 | 861,000 | 757,500 | 626,000 |
| December.... | *5,071,595 | 4,521,208 | 12.2 | 4,093,595 | 3,649,208 | 1,204,000 | 1,045,000 | 2,342,595 | 2,089,208 | 547,000 | 515,000 | 978,000 | 872,000 | 803,000 | 731,000 |

* Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities, minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.

TABLE II—CENTRAL-STATION FINANCIAL OPERATIONS FOR THREE MONTHS IN THE UNITED STATES
(100 per Cent of the Industry)

| Month | Gross Revenue from Sale of Energy† | | | Operating and Maintenance Expenses‡ | | | Operating Ratio | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Steam Plants | | Hydro Plants | | Combined Steam and Hydro Plants | |
| | 1924 Thousands | 1923 Thousands | Per Cent Increase | 1924 Thousands | 1923 Thousands | Per Cent Increase | 1924 | 1923 | 1924 | 1923 | 1924 | 1923 |
| October..... | 111,200 | 103,500 | 7.4 | 51,600 | 48,650 | 6.1 | 48.9 | 52.0 | 28.7 | 26.3 | 48.2 | 47.1 |
| November..... | 120,300 | 112,300 | 7.1 | 51,700 | 49,100 | 5.3 | 46.2 | 50.0 | 25.0 | 24.0 | 45.0 | 42.3 |
| December..... | 132,200 | 118,800 | 11.2 | 56,500 | 52,300 | 7.8 | 45.8 | 48.0 | 27.4 | 26.2 | 44.0 | 44.0 |

†Aggregate gross revenue from actual consumers and sales to other public utilities for resale, involving a certain amount of duplication.
‡Do not include interest, taxes, depreciation or sinking fund

# Construction in 1925 Put at $580,000,000

## Central-Station Company Budgets Indicate Record Expenditures for Extensions to Distribution Systems—Large Additions to Hydro-Electric Plant Installations

CENTRAL-STATION budgets authorized for new construction on generating, transmission and distribution systems during 1925 total $579,830,000, in accordance with the reports received by the ELECTRICAL WORLD. Of this amount $168,760,000, or 29.0 per cent, will be expended for additions and extensions to steam-electric plants; $95,750,000, or 16.6 per cent, for hydro-electric plants; $115,400,000, or 19.9 per cent, for transmission systems, and $199,920,000, or 34.5 per cent, for distribution systems.

Three outstanding facts are to be found disclosed by these construction figures for 1925: First is the fact that two hundred million dollars, or more than one-third of the total expenditures, will be for extensions to the distribution systems of the country, a figure greatly in excess of any other construction item. Such a segregation of the nation's construction budget is clearly indicative of a new alignment in central-station operations. Prior to this year the expenditure for steam-electric generating plants has always been the leading item of central-station expansion, followed by the value of distribution line extensions. With 1925, however, the industry's expenditure for steam-electric plants falls about thirty-one million dollars below the amount to be spent on distribution systems. Two inferences may be drawn from these apparently changed conditions: First, the record additions made to the steam-electric plants during the past year were such as to bring the installed generator rating of the country to such a figure as to carry the additional load which is to be expected by the companies during 1925, or, second, through interconnection and mergers of company systems, the industry has arrived at the point where, through the operations of the superpower type of systems, additional power is available which calls for increased attention to the distribution of that power to the ultimate consumer. If this latter conclusion is correct, then the industry has reached a new milestone in its development.

All but two sections of the country reported increases in the amounts which will be spent during 1925 for extensions to the distribution systems as compared with 1924. Companies operating in the South Atlantic States will spend almost three times as much this year as last, and the distribution extensions of the North Central States will exceed the 1924 extensions by more than eighteen million dollars. The South Central States will spend twice as much on distribution systems as last year and the Pacific States will be called upon to spend a record sum for this type of construction.

The second outstanding fact to be drawn from these data on 1925 construction is the large decrease in the expected expenditure by companies operating in the Middle Atlantic States, which include New York, New

TABLE I—TOTAL VALUE OF ALL ADDITIONS AND EXTENSIONS TO CENTRAL STATION GENERATING AND DISTRIBUTING SYSTEMS DURING 1921, 1922, 1923, 1924 AND 1925

| Section | 1921 | 1922 | 1923 | 1924 | 1925 |
|---|---|---|---|---|---|
| New England States | $13,634,000 | $15,225,000 | $24,996,000 | $55,200,000 | $42,130,000 |
| Middle Atlantic States | 29,502,000 | 86,300,000 | 186,200,000 | 204,650,000 | 140,990,000 |
| South Atlantic States | 21,771,000 | 27,975,000 | 56,960,000 | 67,280,000 | 87,010,000 |
| North Central States | 67,900,000 | 96,700,000 | 206,180,000 | 218,950,000 | 184,240,000 |
| South Central States | 7,480,000 | 21,830,000 | 25,145,000 | 37,180,000 | 19,870,000 |
| Mountain States | 747,000 | 2,241,000 | 7,652,000 | 25,980,000 | 16,120,000 |
| Pacific States | 81,284,000 | 73,745,000 | 95,010,000 | 83,200,000 | 89,470,000 |
| Totals for United States | $222,318,000 | $324,016,000 | $602,143,000 | $692,440,000 | $579,830,000 |

TABLE II—VALUE OF PROPOSED ADDITIONS AND EXTENSIONS TO ALL GENERATING AND DISTRIBUTING SYSTEMS OF THE UNITED STATES DURING 1925

| Section | Generating Plants | | | Distribution | | | Total Value of All Additions and Extensions |
|---|---|---|---|---|---|---|---|
| | Fuel-Burning Plants | Hydro-Electric Plants | Total Value of Additions and Extensions | Transmission Systems | Distribution Systems | Total Value of Additions and Extensions | |
| New England States | $14,540,000 | $1,380,000 | $15,920,000 | $7,170,000 | $19,040,000 | $26,210,000 | $42,130,000 |
| Middle Atlantic States | 67,500,000 | 3,780,000 | 71,280,000 | 25,450,000 | 44,260,000 | 69,710,000 | 140,990,000 |
| South Atlantic States | 4,110,000 | 34,800,000 | 38,910,000 | 24,100,000 | 24,000,000 | 48,100,000 | 87,010,000 |
| North Central States | 72,250,000 | 8,200,000 | 80,450,000 | 45,620,000 | 58,170,000 | 103,790,000 | 184,240,000 |
| South Central States | 1,460,000 | 490,000 | 1,950,000 | 4,080,000 | 13,840,000 | 17,920,000 | 19,870,000 |
| Mountain States | 600,000 | 13,700,000 | 14,300,000 | 1,210,000 | 610,000 | 1,820,000 | 16,120,000 |
| Pacific States | 8,300,000 | 33,400,000 | 41,700,000 | 7,770,000 | 40,000,000 | 47,770,000 | 89,470,000 |
| Totals for United States | $168,760,000 | $95,750,000 | $264,510,000 | $115,400,000 | $199,920,000 | $315,320,000 | $579,830,000 |

TABLE III—VALUE OF ADDITIONS AND EXTENSIONS TO GENERATING PLANTS DURING 1921, 1922, 1923, 1924 AND 1925

| Section | Fuel Electric Generating Plants — Value of Proposed Additions | | | | | Hydro-Electric Generating Plants — Value of Proposed Additions | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1921 | 1922 | 1923 | 1924 | 1925 | 1921 | 1922 | 1923 | 1924 | 1925 |
| New England States | $8,085,000 | $5,870,000 | $6,270,000 | $26,600,000 | $14,540,000 | $1,480,000 | $3,690,000 | $4,626,000 | $5,260,000 | $1,380,000 |
| Middle Atlantic States | 10,430,000 | 41,250,000 | 66,800,000 | 68,300,000 | 67,500,000 | 2,458,000 | 7,240,000 | 11,300,000 | 36,500,000 | 3,780,000 |
| South Atlantic States | 5,004,000 | 6,890,000 | 22,700,000 | 23,600,000 | 4,110,000 | 7,000,000 | 10,900,000 | 10,000,000 | 16,240,000 | 34,800,000 |
| North Central States | 22,020,000 | 34,700,000 | 107,900,000 | 127,500,000 | 72,250,000 | 2,680,000 | 9,800,000 | 5,180,000 | 7,200,000 | 8,200,000 |
| South Central States | 1,920,000 | 6,460,000 | 1,455,000 | 10,600,000 | 1,460,000 | 1,110,000 | 6,000,000 | 4,490,000 | 6,360,000 | 490,000 |
| Mountain States | 72,000 | 828,000 | 802,000 | 10,100,000 | 600,000 | 58,000 | 310,000 | 4,000,000 | 3,880,000 | 13,700,000 |
| Pacific States | 2,327,000 | 4,545,000 | 3,490,000 | 3,000,000 | 8,300,000 | 38,030,000 | 25,850,000 | 34,800,000 | 34,100,000 | 33,400,000 |
| Totals for U. S. | $49,858,000 | $100,543,000 | $209,417,000 | $269,700,000 | $168,760,000 | $52,816,000 | $63,790,000 | $74,396,000 | $109,540,000 | $95,750,000 |

TABLE IV—VALUE OF ADDITIONS AND EXTENSIONS TO TRANSMISSION AND DISTRIBUTING SYSTEMS DURING 1921, 1922, 1923, 1924 AND 1925

| Section | Tranmission Systems — Value of Proposed Additions | | | | | Distribution Systems — Value of Proposed Additions | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1921 | 1922 | 1923 | 1924 | 1925 | 1921 | 1922 | 1923 | 1924 | 1925 |
| New England States | $1,440,000 | $2,570,000 | $6,680,000 | $10,720,000 | $7,170,000 | $2,629,000 | $3,095,000 | $7,420,000 | $12,620,000 | $19,040,000 |
| Middle Atlantic States | 8,240,000 | 20,130,000 | 31,200,000 | 26,350,000 | 25,450,000 | 8,374,000 | 17,680,000 | 76,900,000 | 73,500,000 | 44,260,000 |
| South Atlantic States | 6,197,000 | 5,140,000 | 11,920,000 | 18,500,000 | 24,100,000 | 3,570,000 | 5,045,000 | 12,340,000 | 8,940,000 | 24,000,000 |
| North Central States | 20,510,000 | 22,000,000 | 44,800,000 | 43,930,000 | 45,620,000 | 22,690,000 | 30,200,000 | 48,300,000 | 40,320,000 | 58,170,000 |
| South Central States | 2,230,000 | 4,150,000 | 9,970,000 | 14,900,000 | 4,080,000 | 2,220,000 | 5,220,000 | 9,230,000 | 5,320,000 | 13,840,000 |
| Mountain States | 500,000 | 148,000 | 610,000 | 9,630,000 | 1,210,000 | 117,000 | 955,000 | 2,240,000 | 2,370,000 | 610,000 |
| Pacific States | 21,450,000 | 21,450,000 | 20,020,000 | 10,160,000 | 7,770,000 | 19,477,000 | 21,900,000 | 36,700,000 | 35,940,000 | 40,000,000 |
| Totals for U. S. | $60,567,000 | $75,588,000 | $125,200,000 | $134,190,000 | $115,400,000 | $59,077,000 | $84,095,000 | $193,130,000 | $179,010,000 | $199,920,000 |

Jersey and Pennsylvania. The expenditures for hydro-electric plants and distribution systems in this section are materially below those of previous years, and the transmission extensions are also less. While the amount which is to be spent in this section on steam-electric plants is greater than for any previous year, yet a study of the budgets indicates that an unusually large proportion of these expenditures is for power plant equipment, the added generator rating totaling only 305,900 kw., as against 678,000 kw. in 1923 and 451,000 kw. in 1924. The generator additions to the hydro-electric plants of the Middle Atlantic States during 1925 are almost negligible. These facts lead to the question as to whether the industry in the Middle Atlantic States will continue to grow at the same annual rate. This inference is borne out by the expected growth of one of the largest companies operating in the section, which added the largest number of customers to its circuits in 1924 and which expects that hereafter the number of new customers added each year will not approach the 1924 record. Unusually large expenditures, however, were made for construction in this section during 1924, so that the lesser number of new customers indicated for 1925 may be but the result of a slight overexpansion during the previous year.

The third outstanding fact to be drawn from the national figures is the continued large amounts to be spent on additions to hydro-electric plants and the large increase in the generator rating of these plants. This is very largely due to the new plants of this type which will be completed during 1925 by companies operating in the Mountain and Pacific States. A total of 234,000 kva. in hydro-electric installation was completed in these sections during 1924, but in 1925 a total of 342,000 kva. in new hydro-electric installation will be put into operation. The total rating to be added to the hydro-electric plants of the country as a whole, however, is approximately the same as during 1924, since several sections of the country will not materially increase the rating of such plants during the year.

## Fundamentals of Theater Lighting Explained by Authority

SOME of the fundamental principles which determine the methods of illuminating Balaban & Katz theater auditoriums and of producing stage effects were explained and demonstrated to a Chicago group of illuminating engineers recently by R. Q. Dalton, supervisor of illuminating effects for these theaters. The meeting was held under the auspices of the Chicago Section of the Illuminating Engineering Society.

Efficiency of illumination is a major consideration in auditorium lighting, Mr. Dalton explained, but not in stage illumination, ease of producing effective results being more important there. White light sources are used little, if any, because they do not produce pleasing effects and because they disclose imperfections. Instead, synthetic light is used made up of red, blue and yellow green or amber light, which can be varied in intensity to give any color desired. About forty gelatine color screens are employed to make it possible to produce desired colors quickly with spot lamps, etc.

In the Balaban & Katz theaters the auditorium and stage lighting are not used simultaneously. Furthermore, stage backgrounds are illuminated separately from figures on the stage, the former being lighted by border, side and bunch lamps, the latter by spot and proscenium arch lamps. To produce light and shadow effects complementary colors are always used.

Very few arc lamps are used in these theaters except for projection purposes, incandescent lamps being more popular. Many 1,000-watt lamps and also 2,000-watt lamps are used for spots. In making synthetic light, red and blue glass lamps are used with sprayed green or amber lamps. To produce white light it has been found that two 60-watt blue, two 40-watt green and one 25-watt red lamps produce approximately white light and also other colors if their respective intensities are varied. Methods of employing illumination to produce many striking stage effects were explained.

TABLE V—ADDITIONS AND EXTENSIONS TO CENTRAL-STATION GENERATOR EQUIPMENT DURING 1921, 1922, 1923, 1924 AND 1925

| Section | Fuel-Burning Plants — Additions in Generator Rating During Year—Kw. | | | | | Hydro-Electric Plants — Additions in Generator Rating During Year—Kw. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1921 | 1922 | 1923 | 1924 | 1925 | 1921 | 1922 | 1923 | 1924 | 1925 |
| New England States | 236,000 | 76,000 | 151,200 | 170,000 | 162,500 | 18,700 | 39,000 | 24,000 | 27,200 | 32,000 |
| Middle Atlantic States | 102,000 | 332,000 | 678,000 | 451,000 | 305,000 | 23,300 | 256,000 | 180,000 | 115,000 | 4,500 |
| South Atlantic States | 106,000 | 76,000 | 200,000 | 156,000 | 8,500 | 155,000 | 222,000 | 240,000 | 80,000 | 140,000 |
| North Central States | 404,000 | 388,000 | 867,500 | 842,000 | 880,000 | 60,000 | 78,000 | 64,000 | 36,800 | 24,000 |
| South Central States | 15,000 | 78,000 | 29,100 | 69,600 | 40,000 | 30,000 | 32,000 | 90,000 | 33,600 | 2,800 |
| Mountain States | 1,000 | 20,000 | 16,800 | 9,600 | 1,700 | 2,200 | 0 | 25,000 | 20,000 | 37,000 |
| Pacific States | 37,500 | 58,000 | 44,800 | 88,000 | 56,700 | 216,000 | 117,000 | 280,000 | 167,000 | 237,000 |
| Totals for United States | 901,500 | 1,028,000 | 1,987,400 | 1,876,200 | 1,454,400 | 505,200 | 744,000 | 903,000 | 479,600 | 477,300 |

# Letters from Our Readers

## Complexity in Home Lighting

*To the Editor of the* ELECTRICAL WORLD:

I have read with much interest the letter by Jack North in the ELECTRICAL WORLD for February 14, in which he suggests that more definite recommendations for lighting equipment in the home are necessary. Certainly we have not reached the point of complete standardization of lighting equipment in this field, and owing to the varied lighting problems in the home and the extremely different types of fixtures which are necessary to serve a variety of period styles, tastes and utilitarian and decorative aspects of lighting, this field cannot be completely standardized.

I am sure Mr. North does not lose sight of the fact that in the booklet entitled "Home-Lighting Recipes" to which he refers a great advance was made over the previous chaotic condition. It may seem advisable to standardize on a minimum rating of watts per square foot for utilitarian purposes, but if this were made a rule, it could not possibly be followed throughout the various rooms and homes.

For example, if a pendent dome were used to illuminate the dining table and if a 75-watt lamp provided satisfactory illumination, it would matter little whether this room were 10 ft. square or 30 ft. square in so far as lighting the dining table was concerned. Obviously the watts per square foot would vary in the two cases in the proportion of one to nine. Then if a candle fixture were used instead of a dome, five 25-watt lamps might be considered satisfactory by the householder, but if some one desired brackets and candle portables on the buffet, these would increase the watts per square foot considerably.

In the living room of moderate size a five-light "shower" might be considered satisfactory, and some persons would be satisfied with a total of 125 watts while others might want 200 watts. This would apply only to the ceiling fixture. The living room is a natural domain of portable lamps, and one householder might consider one sufficient, while another might have six or eight portables. The watts per square foot obviously under these various conditions might vary from one to five or even ten.

A watts-per-square-foot view of home lighting certainly cannot take into account the extreme variety of fixtures, of tastes and of complications of utilitarian and esthetic lighting. A better recommendation, in my opinion, for most of the rooms of the house would be confined to lamp sizes for various types of lighting equipment.

I have been engaged in analyzing and specifying home lighting for a dozen years, and I have encountered little need for a watts-per-square-foot basis. Furthermore, I do not see that this basis gets us anywhere with the exception of such a room as the kitchen. Home lighting is very complex, and an attempt to consider it on the same basis as has been found more or less successful in offices and industrial lighting cannot be successful. A simple rule may give satisfaction to some of the leaders in electrical development, but it does not alter the complexity of the problems with which we are confronted in home lighting. Perhaps the complexity of the lighting problems in the home is unfortunate and annoying; nevertheless, a simple rule will not alter the state of affairs.

This complexity doubtless was one of the primary causes of the long neglect which home lighting suffered. Certainly great advances have been made by standardizing certain types of fixtures, but none the less the householder will not and should not accept standardization which would be complete because that would impose unreasonable restrictions in a field in which period style, taste and decorative uses of light are such important factors.

It may be well to establish a minimum rating in watts per square foot in certain workplaces, such as the kitchen, but this would leave unsolved most of the problems of home lighting, which are far more complex. Furthermore, the recommendations now in use for these workplaces have been arrived at by due consideration of watts per square foot. M. LUCKIESH,

Director Lighting Research Laboratory.
National Lamp Works of General Electric Company,
Nela Park, Cleveland, Ohio.

## Lurking Dangers in Imported Fittings

*To the Editor of the* ELECTRICAL WORLD:

I am very much pleased to find by your recent editorial entitled "The Menace of Sub-standard Imported Electrical Devices" that you are taking an active interest in this important matter. It would appear to me that one of the root difficulties is the fact that in some cases there are not sufficient standards applying to some of the devices that are at present being imported. To illustrate this, in the Canadian city where I live we recently found a large quantity of German two-light cluster plugs on the local market. These are being retailed at 35 cents each. They were imported by a local jobber from New York, and therefore two custom duties were very likely paid upon them. In looking into the matter we found that they were, as you state, flimsy in construction and that the male screw shell projected beyond the fiber lining of a standard medium-base socket. We informed the local jobber that we could not permit these to be sold, but he found means of shortening up the male screw shell, and we could not then state that the appliance was actually dangerous. In taking the matter up with the Underwriters' Laboratories, however, it appears that there is no standard whatever covering these devices.

I have passed this information on to certain Canadian manufacturers of similar articles with the suggestion that they should "get busy" and look into this whole question, with the idea that a standard might be formulated, but in doing this we would have to be extremely careful that such a standard is not too rigorous, otherwise there would be no chance of the American or Canadian manufacturer competing with these imported devices. At the same time, the lack of a standard certainly precludes some adverse criticism that could be leveled against sub-standard devices, as there is nothing to base one's opinion upon except one's own idea of what form the device should take. If one wanted to condemn this particular device, I cannot find that there is any direct reference in the National Electrical Code to the fact that the male screw shell should not exceed a certain length. Fortunately, in my city we have very extensive powers which enable us to notify dealers that a device judged dangerous by this department must not be sold. Similar powers are being exercised in some of your cities, and others again have power to prohibit the sale of any unapproved devices. A CITY ELECTRICIAN.

# Central Station and Industrial Practice

## Locating Lost Switch Loops and Concealed Wires

BY ARTHUR H. FORD
Professor of Electrical Engineering, State University of Iowa

A METHOD is herewith presented for locating concealed wires or switch loops which have been omitted on the wiring diagram or have not been placed in the location shown. The particular installation on which this test was used is a knob-and-tube job with iron switch boxes. The wiring had been plastered in and the location of one switch loop forgotten.

The apparatus used can be very easily obtained. It consists of a radio set with audion detector and two stages of audio-frequency amplification. A pocket compass is also required.

Connection was made between the house wiring and the alternating-current supply, and the switch loop was energized by twisting the wires together at the ceiling outlet. The line connections were reversed in order to connect the wires in the ceiling to the ungrounded side of the system. The fuses were removed from all branch circuits except the one under test.

The filament of the audion was connected to a water pipe, and the grid was connected to a wire long enough to reach any part of the room in one wall of which the switch loop was located. A section of this wire about 2 ft. in length was placed next to the ceiling and moved around the ceiling outlet, keeping one end pointing toward the outlet. When the wire was in a certain position the hum in the telephone receivers connected to the radio set was a maximum, showing that the test wire was near the portion of the switch loop installed in the ceiling. This indicated the wall in which the switch loop was located.

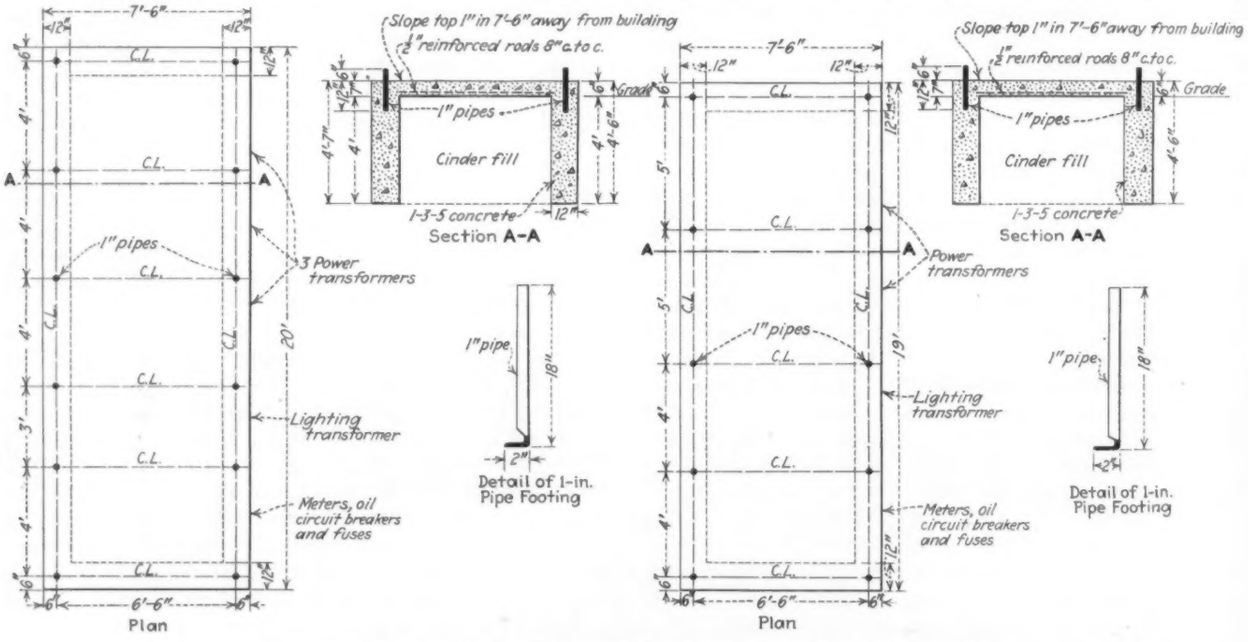
A similar test with apparatus was made with the test section of the wire held vertically against this wall. The loudness of the hum in the telephone receivers indicated the location of the switch loop within a space about a foot wide. The pocket compass was now used for determining the exact location of the switch box. The motion of the needle was noted as the compass was moved along the wall. At a certain place the angular position of the needle changed suddenly, indicating the position of the iron switch box. Upon driving an ice pick into the wall the end struck the switch box at the first trial.

Care must be taken to keep the radio set and the test wire near the center of the room, so that as little noise as possible will be picked up from other wires than the one which it is desired to locate.

In order to test the general applicability of this method of locating wires, it was tried on wires in conduit in a reinforced concrete building. It worked satisfactorily even under these conditions. Should alternating-current power supply not be available, the wires which it is desired to trace can be connected to an insulation testing magneto or the induction coil of a telephone lineman's fault finder.

## Customer's Substation Foundations

UNDER an agreement with the Utica Gas & Electric Company certain 4,000-volt transformer customers are required to furnish the transformer foundation and put a fence around it. The company has prepared standard drawings which it gives to the customer for him to follow. Two of these plans are given herewith, one for three power transformers, one lighting transformer, meters, oil circuit breakers and fuses and the other for two power transformers, the rest of the equipment being the same as in the first case.




CONCRETE TRANSFORMER SUBSTATION PLATFORM FURNISHED BY CUSTOMER

With slight changes these two plans are used for virtually any set of conditions that are encountered.

When the foundation is laid 1-in. pipes flattened and bent at one end as shown in detail are set in the concrete. Then over this the company slips 1¼-in. pipe forming part of the framework to which the apparatus is attached. The 1¼-in. pipe is held to the 1-in. pipe by means of a pin slipped through both.

The customer supplies only the foundation and fence while the power company supplies the pipe framework, transformers, etc.

# Handling Trouble Calls Within Half Hour

BY J. T. DYSART
Superintendent Trouble Department, Kansas City (Mo.) Power & Light Company

RECOGNIZING the advantages of satisfied customers, the Kansas City Power & Light Company has been conducting its trouble department in such a way that all trouble calls are, on the average, handled within half an hour after receipt of the call. To make its work as effective as possible a few principles that seem fundamental have been applied. First of all, all trouble calls are routed through a special switchboard in the trouble department. The work of receiving these calls and dispatching the troublemen is divided between two men. The district served is divided into sections, each of which has troublemen who are responsible for those sections. They are provided with adequate equipment and transportation facilities and are required to "call in" periodically when not handling work. Meetings are held monthly to impress the men with their obligations to the public. Where interruptions of service are necessary, the customers are warned of the duration, and in cases of serious unexpected trouble explanations are given to inquirers regarding the nature of the trouble and the time when restoration of service may be expected.

This department is responsible for handling all trouble calls from customers or regarding street rights, connection and disconnection of services and line switching for the load dispatcher. The territory within its domain includes five counties. To cover these counties three shifts with a total of thirty-one men (exclusive of telephone operators) are employed. One shift working from 11 p.m. to 7 a.m. consists of four men; the second shift (8 a.m. to 5 p.m.) consists of seven men, and the third shift (2 p.m. to 11 p.m.) consists of eleven men. Two additional men are engaged strictly in making series circuit tests; two more patrol the series street-lighting system. Five men handle any boulevard lighting trouble. An attempt is made to distribute the troublemen over the five counties, but no definite boundaries are established between them.

Two of the men engaged in boulevard lighting trouble are provided with a Ford truck, and the other three have a Dodge touring car. Two of the men on the 2 p.m.-11 p.m. shift have a Dodge truck with which to handle light repairs that the regular troublemen cannot handle. All other troublemen are provided with a small car equipped with a small ladder and standard emergency kit. The men furnish their own pliers, screwdrivers, safety belt and climbers.

TROUBLE REPORT Nº 22106

Name .....
Address .....
Received by .....
Time .....
Details .....

Assigned to .....
Time .....

Time Repaired .....
Fuses Blown .....
Inside Trouble .....
O. K. on Arrival .....
See Line Trouble Order No. .....
Details .....

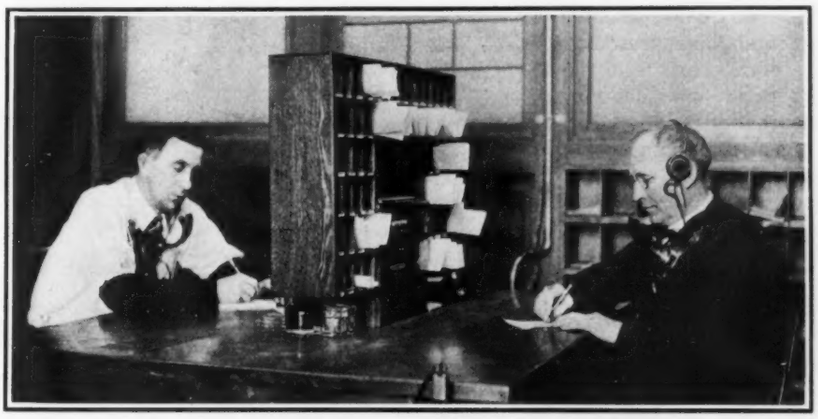
FORM OF TROUBLE REPORT USED IN SCHEDULING WORK

The company furnishes rubber blankets, "hogs," gloves, raincoats and boots; also lamp removers, test lamps, portable telephone, meter sealers, flashlamps, fire extinguishers, grounding chains and belt cutters. Among the materials carried are insulators, pins, brackets, wire, fuses of all kinds, transformer cut-outs and plugs and lamps.

In its street-lighting contracts with communities the company requires the police department to report trouble, although, as already mentioned, patrolmen are also employed. When the service is not going to be used for some time the meter department calls this department to disconnect the equipment on the poles. Vice versa, when service is to be continued the trouble department is called in order to reconnect equipment.

If any linemen have to work on lines that have to be "killed," or customers want to work on equipment, the trouble department is sometimes called to de-energize the lines. The regular troubleman clear "opens," "grounds," "crosses," etc.

The men call in by telephone from their respective districts and never come into the office during working hours except for material or equipment. When they start out at the beginning of their shift they usually call in for orders from the garage where they keep their car, or any other convenient place, using one of the "blind numbers" which connect them directly with the load-trouble dispatcher without going through the company's general operator.



TROUBLE DEPARTMENT, WHERE CALLS ARE RECEIVED AND ORDERS DISPATCHED

After handling each trouble call they call in by using the customer's telephone, if there is one, or tapping their portable set to any telephone lead except in the pay-telephone district, in which case they pay the telephone user for the call and turn in

an expense slip. When not engaged in handling trouble, the troublemen must call in every twenty minutes for instructions.

When a trouble call comes in from outside, it is routed through the trouble department switchboard by the regular company switchboard operator. The trouble department operator who receives the call makes out the report on a slip like the one shown and passes it to the trouble dispatcher opposite him, who files it in front of him in a box assigned to the troubleman who will be called upon to handle the matter. There are two boxes for each troublemen—one "awaiting attention," the other "work completed." When a troubleman calls in, the orders in his box are read to him in their order of importance, special attention being given to hospitals, power customers and others whose demands are especially urgent. The dispatcher then records the name of the man to whom the job was assigned and the time, replacing the order in the "awaiting attention" box. When the trouble is reported handled, the information at the bottom of the trouble report is filled in by the dispatcher and the report filed in the "work completed" box.

At present the company is investigating the advisability of having a special crew on hand to handle jobs that demand immediate attention.

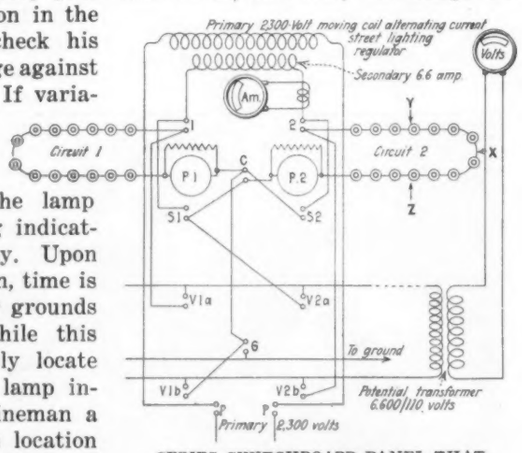
# Chart for Locating Street-Lighting Grounds

## Method Used in Kalamazoo for Detecting Faults in Circuits Described in Detail—Design of Special Switchboard and How It Is Used

BY EARL E. NORMAN
Superintendent Department of Public Utilities, Kalamazoo, Mich.

A SPECIALLY designed panelboard and a set of eight voltage-distance charts have solved the problem of quickly determining grounds in the series street-lighting circuits of the city of Kalamazoo. The principle of these charts lies in the knowledge that the voltage in a series circuit depends upon the number of lamps burning in that circuit. By plotting a chart for each circuit showing the lamp voltage drop plus line drop against its position in the circuit the operator can check his measured switchboard voltage against that shown by the charts. If variations occur, trouble or grounds are present. By referring to the chart the operator can determine the lamp nearest the voltage reading indicating a ground in that locality. Upon reporting this to the lineman, time is not wasted in searching for grounds in the entire circuit. While this method does not necessarily locate the ground exactly at the lamp indicated, it does give the lineman a clue as to the approximate location of the ground, which is usually found within the next two or three lamps from the one indicated.

To provide checking switchboard voltage readings of the eight circuits the specially constructed panelboard shown herewith was built. Circuits 1 and 2 are put in series with each other and the transformer secondary by plugging in switches 1, *C* and 2. By plugging in *G* a ground is placed on a common connection between the two circuits. $P_1$ and $P_2$ are pilot lights of the two respective circuits mounted on the switchboard. These pilots are standard 1,000-lumen, 6.6-amp. series incandescent lamps shunted by a resistance so that they just glow. Now, if all four plugs are in and no ground exists on either external circuit, both circuits will operate properly. If a ground occurs at *Z*, however, the lamps between this point and the ground plug *G*, including the pilot light $P_2$, will be shorted out by the current passing through the ground *Z* and *G*. This will at once be detected by the plant operator, through the extinguishing of pilot light $P_2$. Service on the circuit may be restored by removing either the accidental ground at *Z* or the ground purposely made at *G*. When convenient, the accidental ground is located and removed. But if this cannot be done promptly, plug *G* is removed until the accidental ground *Z* is located and removed.




SERIES SWITCHBOARD PANEL THAT AFFORDS VOLTAGE READINGS FOR LOCATING GROUNDS

In making a voltage-distance chart the problem arose of keeping it perpetually up to date as new lamps were added. If a list of the lamps on the circuit was made in the order in which they were connected and each lamp's voltage written beneath the lamp, such a list would be all right if no further additions were made to the circuit. If the addition happened to be between the plug *C* and the next line lamp, the new lamp could simply be added to the bottom of the circuit list and the voltage across it added to the total previous voltage. But, however, if the addition occurred in the middle of the circuit, perhaps at *X*, it would then be necessary to increase the voltage of every lamp from *X* to the grounded end of the circuit. On a system adding fifty lamps yearly this method would be obviously impracticable.

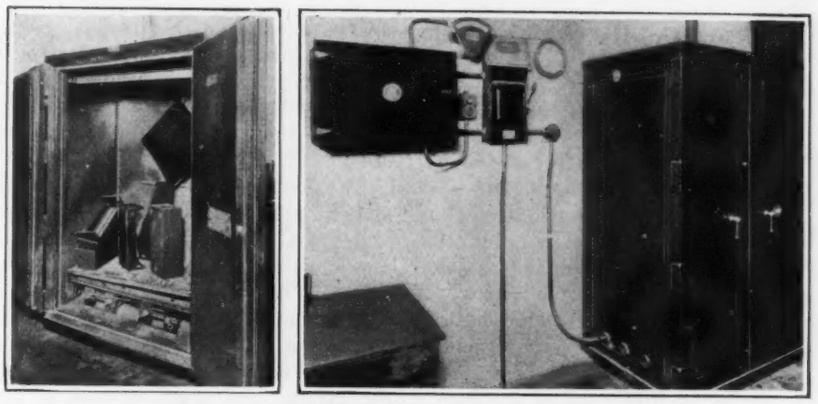
Instead a simple system is used which keeps the chart voltage drop constantly up to date. A list of the circuit lamps was made in the order in which they were connected in the circuit. Instead of spacing the names of these lamps evenly on the list, the spacing of each lamp was made proportional to its voltage. This voltage determination required an accurate check. In order to determine the proper voltage allocation for each lamp a test was made, during which the voltage on each of the eight circuits was read about every five minutes while the current was held normal and the circuit was carefully patrolled. The highest voltage indicated during this period was assumed to be the total voltage of that circuit. The voltage across the lamps only for each circuit was then calculated by the rating of the lamps, which, of course, was somewhat less than the measured voltage—the difference being the line loss, which varied on different circuits from 6½ per cent to 18 per cent. This line loss in volts was then allocated proportionally to each lamp and added to the normal voltage rating of that lamp. For example, on one circuit the circuit voltage measured 2,810, while the voltage calculated across the lamps was only 2,437. Dividing this voltage difference equally among the ninety-three lamps in this cir-

cuit left a voltage of 4.02 to be added to the normal voltage of each lamp. Thus for a 4,000-lumen, 6.6-amp. lamp rated at 36.8 volts the total voltage on that lamp, including line drop, would be 40.82. The same method was used in determining the total voltage drop for the 2,500-lumen lamp, which was 27.32. The totals for this circuit were then added, taking the lamps in order beginning at plug 2 and a sub-total with each additional lamp, which thus gave the total voltage from this plug to each successive lamp. The spacings on the chart were then marked off, using a scale of 200 volts to the inch, and the list was copied by a typewriter onto this scale, each lamp going into its allocated space.

An unusual arrangement is employed in providing space for new units. The scale by which the voltage is indicated is not drawn on the same piece of paper on which the lamp list is typed. Instead this voltage scale is mounted on a separate strip. This strip, however, is permanently mounted on a bulletin board, while the list of lamps is mounted adjacent thereto with an arrangement whereby this list can slide in a slot so that it may be changed as new lamps are added. Thus when a new lamp is added, for example, to circuit No. 2, if it is a 2,500-lumen lamp, the name of the lamp is typed on a piece of paper, the vertical spacing of which has a length equivalent to 27.32 volts on a scale of 200 volts to the inch.

The voltage list referred to above is then cut in two at the point where the new lamp is to be inserted, and the list is then separated just enough to insert the equivalent voltage drop for this lamp. The lamps between the new one and *C* are then moved downward, thus increasing the indicated voltage on these lamps to the scale of 200 volts per inch. Work orders authorizing the installation of new lamps are "O.K.'d" with a rubber stamp, which provides a place in which the chief engineer places his initials when he changes the voltage list to indicate the new voltage condition set up by this new lamp.

The connections as shown are so made that the voltage can be measured by the voltmeter across any single circuit or pair of circuits. Reference to the diagram will show that by plugging in $V_{1a}$ and $V_{1b}$ the voltage across circuit 1 will be indicated by the voltmeter. Likewise, $V_{2a}$ and $V_{2b}$ will give the voltage across the circuit 2, while for the total voltage across both circuits $V_{1a}$ and $V_{2b}$ must be closed. To cut circuit 2 out of service the operator must close $S_2$ and open 2 and *C*. Similar switching on circuit 1 will open that circuit. The board also tells the operator when a ground occurs because the corresponding pilot light goes out.



INTERIOR AND EXTERIOR OF CONVERTED ELECTRIC OVEN

## Fireproof Vault Converted to Electric Oven

BY C. H. STEVENSON
Commonwealth Edison Company, Chicago, Ill.

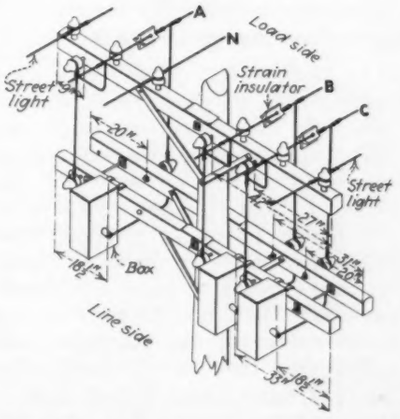
WHEN an oven was needed some time ago by the General Fireproof Company for baking japan on refinished parts of steel desks this company quite naturally thought of its fireproof vault, which is made to hold a temperature of less than 250 deg. F. on the inside for two hours while subject to a temperature of 1,800 deg. F. to 2,000 deg. F. on the outside. The company reasoned that if this safe, which is insulated with 4 in. of amorphous silicate and asbestos fiber, could hold the heat out, it should also be able to hold the heat in.

Accordingly two 2½-kw. Westinghouse oven heaters were installed in the bottom of one of the company's larger-sized vaults. Three holes were drilled on each side of the bottom, and a vent pipe was connected at the top to provide for ventilation. A controlling thermometer and a contactor panel were added and the oven was complete.

The most striking part of this installation is its beauty. The inside as well as outside is finished in a glossy dark-green japan trimmed with light green. The metallic parts are brightly nickel-plated. After operating at 250 deg. F. all day, not even the chill is removed from the outside shell.

The oven, which is 44 in. wide, 75 in. high and 35 in. deep, operates about eight hours per day, twenty days per month, at a cost for energy of $15 with electricity at 3 cents per kilowatt-hour.

## Disconnecting Switch Installation




SINCE the series of articles in the ELECTRICAL WORLD on "Overhead Distribution Construction" of the West Penn Power Company were published, some new standards have been adopted. Among these is the one reproduced above for the installation of disconnecting switches on 4,000-volt circuits.

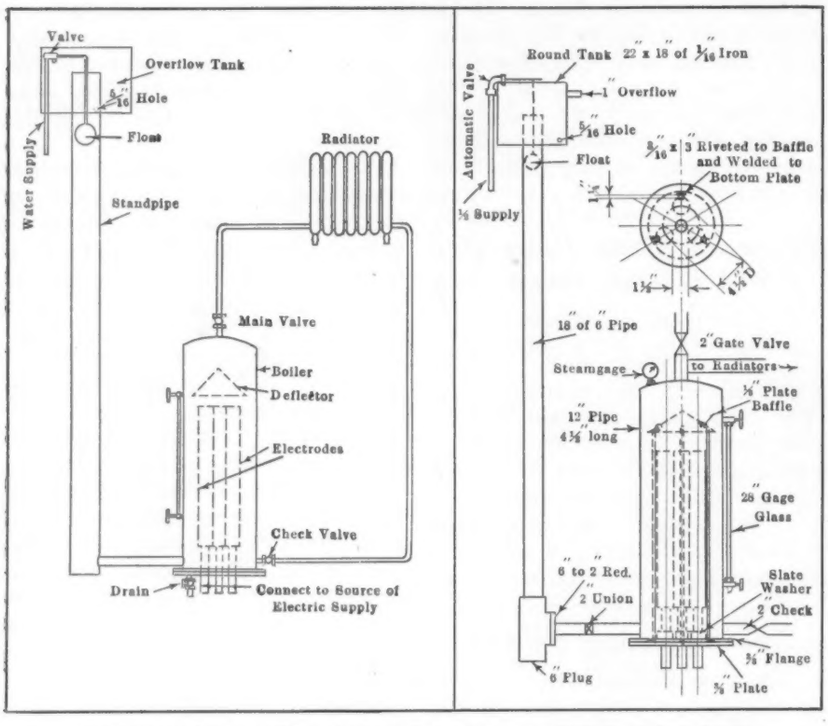
## Fireproofing Cables

FOR fireproofing underground 11,000-volt cables the Syracuse Lighting Company is using ⅜-in. x 3-in. reinforced Johns-Manville "Niagrite." This is saturated in a solution of cement and then wrapped lightly around the cable. Over this a heavy layer of cement mixed to a paste is placed. Such a fireproofing has stood up exceedingly well under all normal conditions and in cases of minor trouble has successfully resisted the entrance of heat to the lead covering. As yet no very serious short circuits or grounds have occurred to test the fireproofing fully.

# Automatically Controlled Electric Boilers

BY W. S. GUTHRIE
Butte, Mont.

THE automatic-control system for electric-steam boilers shown in the accompanying illustration has been found to work out very successfully and has been applied to station and shop heating for a period of more than two years. The solution of this control problem depended on finding how to raise and lower the water to take care of variations in load. The illustration shows how this was worked out on a boiler consisting of vertical metal electrodes




SYSTEM FOR AUTOMATICALLY CONTROLLING ELECTRIC STEAM BOILERS

covered with water to a depth corresponding to the amount of water in the boiler. There are three electrodes made of 30-in. lengths of 2-in. iron pipe welded to 1½-in. rods, the rods passing through insulating bushings in the bottom of the boiler. The shell of the boiler consists of a 4-ft. 6-in. piece of 12-in. iron pipe with a flanged base and welded-in crowned head. The bottom is fitted with packing glands to hold the insulating bushings which surround the rods leading to the electrodes. The electrodes are spaced so that their surface distance from one another is about one and seven-tenths times their distance from the boiler shell. This spacing causes the water to be heated between the electrodes and the boiler shell as well as between the electrodes themselves. Above the electrodes is a deflector or baffle which helps to keep the boiler from priming under sudden increases of demand for steam.

The connections of the heating system are of the return-flow type and must have a tight, easy-lifting check valve at the bottom of the boiler. The main valve at the top of the boiler is used when getting up steam and gradually admitting it to the cold heating system. Without its use the whole system is apt to be filled with water before the boiler begins to generate steam.

The standpipe for the boiler shown is an 18-ft. length of 6-in. pipe connected through a short length of 2-in. pipe with the bottom of the boiler. This length of standpipe will give a maximum steam pressure in the boiler of about 8 lb. per square inch. For higher pressures a longer pipe of smaller diameter must be used. At times, owing to sudden demands for steam, there may be more or less water driven up the standpipe and spilled over the top. To avoid this waste of water a tank is built around the standpipe, about a foot from the top, to act as an overflow catch basin. A ⅝-in. hole is drilled through the standpipe near the bottom of the tank, so as to let the water caught in the tank gradually return to the standpipe when conditions again become normal.

The automatic valve and float are for the purpose of providing make-up water. The valve has a small discharge opening (not more than a ⅛-in hole). In a boiler not to be used continuously the make-up water supply should be handled with a common hand-operated valve, as the automatic valve is apt to be forgotten when the boiler is shut down, causing the whole system to be flooded.

The boiler operates in the following manner: Water is run in until the boiler is filled to within 12 in. of the top. The main valve is then closed and 440-volt, three-phase, alternating current switched on to the three electrodes. The water will soon begin to boil and then go down in the boiler and up the standpipe. At this point the main valve is opened a little, just enough to keep the water near the top of the electrodes, thus gradually admitting steam to the heating system. After the radiators warm up the valve is opened wide and the boiler feeds the system unrestrictedly.

In very few localities is the water alkiline enough to conduct sufficient current at 440 volts to generate the required amount of steam. It will therefore be necessary to add washing soda to the water. The soda is best introduced into the boiler by a simple device such as is used to introduce boiler compound into small boilers. Enough soda should be used to keep the water in the boiler high enough to cover one-half or two-thirds of the surface of the electrodes when the boiler is normally loaded.

A boiler of the size described can do the work of a regular 10-hp. boiler and can run at a constant power consumption of 100 kw. without foaming. The automatic regulation of the boiler covers the range from no load to full load. When the demand for steam increases the water comes down the standpipe, owing to a drop in pressure, and covers a greater area of the electrodes. This increases the energy consumption and generates more steam to meet the demand. If all the radiators are shut off, the boiler pressure goes up and the water leaves the electrodes and raises the water in the standpipe. There will be just enough water touching the electrodes to generate the steam required to take care of heat losses in the boiler and piping. It might seem that very careful spacing of the electrodes would be necessary; however, this has not proved to be the case.

# Commercial Activities and Public Relations

## A Dollar Allowance Sells 119 Percolators

THE electric coffee percolator has long been recognized as a valuable energy-consuming device, but the public does not buy this appliance so readily as it does the more staple electric flatiron or toaster. A number of reasons could be found for this apparent sales resistance, but probably the principal one is the fact that not so much sales effort has been put on the percolator as on other devices. This difficulty was recently overcome, in part at least, by the Winston-Salem (N. C.) branch of the Southern Public Utilities Company in a special ten-day sale.

Records in the Winston-Salem office showed that customers had not been buying percolators as it was believed they should. An appliance of good quality was thereupon selected and so priced that it could be sold at $8.50 with a fair margin of profit. The best window in the salesroom was given over to a display of these percolators. Price tags were used liberally.

The company's demonstrator cooperated in another display on the sales floor, serving coffee to customers who came in. Liberal newspaper space was used explaining that during the sale one dollar would be allowed any woman who brought her old coffeepot to the store and bought a new percolator of the model featured. There were no rules barring pots of ancient service. Any old coffeepot was worth a dollar.

Some of the customers even went to the five and ten-cent stores and bought new pots, went home and gave them a good smoking, then brought them to the store for sale at a dollar each, according to John Paul Lucas, director of public relations for the Southern Public Utilities Company. The company did not object however, as the offer was made as a part of the advertising program.

The sale lasted ten days, during which 119 customers exchanged their old coffee pots for electric percolators to be used on the company's lines. The sale did not, of course, show much net profit, yet it converted 119 Winston-Salem housewives to the use of at least one more electrical appliance for the home. The allowance of a dollar for old coffeepots was not considered to be price cutting but rather part of the advertising appropriation.

## Prize for Efficient Merchandising

THE Watertown (S. D.) Public Service Company, of which W. B. Voth is manager, has won the silver loving cup offered by the Albert Emanuel Company, New York, to that one of its subsidiary companies which made the best showing in merchandising, increased load, net profits, turnover, sales per residence meter and otherwise during the year 1924.

The plan was based on a point system and recognized the load-building value of all appliances as reflected in additional gross revenue. It acted as a check on the tendency to carry too large stocks of merchandise and supplies by offering liberal points for a high rate of turnover, and it also discouraged price cutting by rewarding gross profit as well as net profit.

## High Load Diversity in Baltimore

DATA compiled by the Consolidated Gas, Electric Light & Power Company of Baltimore show that that company has built up and connected to its lines one of the most widely diversified industrial power loads of the country. A survey of the growth of use of electrical energy by industrial and commercial customers of the Consolidated company is the basis of Table I, giving the number of power customers and their total connected load in horsepower from year to year since 1910. How well this business is diversified is shown in Table III, which indicates that the close of the year the company was serving 3,323 customers, representing forty-nine different industries, with a total connected load of 433,076 hp., not including an 88,000-hp. railway load.

Attractive power rates and good service have been important factors in obtaining this business, but the most important have been the intelligent and systematic efforts of the company's industrial power department in changing over isolated plants to the use of central-station power and in influencing new industries to locate in Baltimore. In the latter activity the Consolidated company has on occasions sent its representatives out of the country and even to Europe to help insure the location of new manufacturing plants within its territory.

To measure the economic value of central-station service to an industrial center the Consolidated company has made some interesting estimates showing how purchased power has relieved industry of the necessity of capital outlay for a private plant, thus leaving this money free for the operation and expansion of business. Had the new plants and enlargements of established industries in Baltimore which now use purchased power found it necessary to install their own generators, the amount of capital that would have been invested in wasteful machinery from 1910 to

TABLE II—TOTAL INDUSTRIAL AND COMMERCIAL USE OF POWER IN BALTIMORE

| Year | Kw.-Hr. |
|---|---|
| 1910 | 37,642,573 |
| 1924 | 384,474,539 |
| Per cent increase | 921 |

TABLE I—GROWTH OF BALTIMORE COMPANY'S INDUSTRIAL AND COMMERCIAL POWER CUSTOMERS

| Year Ended Dec. 31 | Total Customer Locations Dec. 31 | Growth by Hp. Connected | Year Ended Dec. 31 | Total Customer Locations Dec. 31 | Growth by Hp. Connected |
|---|---|---|---|---|---|
| 1910 | 1,333 | 53,300 | 1918 | 2,365 | 211,043 |
| 1911 | 1,475 | 61,600 | 1919 | 2,461 | 238,230 |
| 1912 | 1,617 | 63,600 | 1920 | 2,619 | 290,153 |
| 1913 | 1,759 | 104,660 | 1921 | 2,829 | 323,098 |
| 1914 | 1,899 | 118,000 | 1922 | 3,003 | 356,051 |
| 1915 | 1,941 | 140,000 | 1923 | 3,151 | 393,774 |
| 1916 | 2,181 | 164,530 | 1924 | 3,323 | 433,076 |
| 1917 | 2,282 | 195,128 | | | |

TABLE III—DIVERSITY OF USE AMONG ELECTRIC POWER USERS
Showing classification of industrial and commercial customers in Baltimore

| Industry | No. of Customer Locations | Connected Load, Hp. |
|---|---|---|
| Autos, accessories and repairs | 158 | 2,473 |
| Bakers and confectioners | 208 | 4,529 |
| Beds and bedding | 18 | 633 |
| Beverages | 42 | 1,706 |
| Brooms and brushes | 18 | 545 |
| Builders' supplies | 44 | 794 |
| Butchers, canners and packers | 101 | 9,353 |
| Chemicals | 41 | 4,303 |
| Clay industries | 10 | 2,316 |
| Clothing industry | 327 | 5,170 |
| Coal and wood yards | 33 | 400 |
| Coffees and teas | 30 | 420 |
| Creameries and dairies | 47 | 2,800 |
| Department stores | 23 | 3,560 |
| Electrical equipment | 37 | 5,972 |
| Electrolytic works | 1 | 33,056 |
| Fertilizer | 17 | 21,652 |
| Grain, flour and feed | 27 | 4,045 |
| Glass industry | 8 | 2,956 |
| Hotels and restaurants | 32 | 2,648 |
| Ice-cream manufacturers | 30 | 4,150 |
| Ice plants and refrigeration | 29 | 9,627 |
| Laundries | 45 | 962 |
| Leather industry | 17 | 463 |
| Machine shops | 126 | 4,124 |
| Metal industry | 153 | 130,773 |
| Miscellaneous | 101 | 4,222 |
| Musical instruments | 5 | 614 |
| Office buildings and apartment houses | 89 | 5,721 |
| Oils and greases | 35 | 3,388 |
| Paints and pigments | 18 | 786 |
| Paper industries | 51 | 6,580 |
| Printing | 154 | 7,251 |
| Public buildings and institutions | 174 | 16,512 |
| Pumping stations | 25 | 7,429 |
| Railroads and railways | 29 | 45,771 |
| Rubber products | 25 | 1,096 |
| Shipbuilding | 18 | 18,348 |
| Shoemaking | 270 | 1,276 |
| Spices | 3 | 1,225 |
| Stone and concrete | 68 | 8,258 |
| Stores | 193 | 3,634 |
| Telephone and telegraph stations | 4 | 705 |
| Textile | 31 | 10,130 |
| Toys | 11 | 550 |
| Unclassified | 176 | 5,954 |
| Warehouses | 64 | 2,990 |
| Woodworking | 152 | 18,925 |
| Yeast manufacturers | 5 | 2,281 |
| Total | 3,323 | 433,076 |
| United Railways & Electric Company, not included above | | 88,000 |

1924 would have exceeded $40,000,000.

The value of this wide diversification of power load becomes apparent when it is considered that the sale of energy is not dependent upon any special class of industries. The steady, rapid growth of the Consolidated company's sales of energy for power purposes is reflected in the comparison of 1910 with 1924 contained in Table II.

## Value of Personal Service Department

JUST what value lies in the personal service work instituted by the Missouri Gas & Electric Service Company, Lexington, Mo. (see ELECTRICAL WORLD for November 22, 1924, page 1115), may be determined from the report made by Miss Jean Ward, manager, on her first five weeks' work. An analysis of her 287 personal calls on customers presents evidence of very definite results from this type of service.

Twenty prospective stockholders' names were obtained, thirty merchandising prospects were discovered, and of the thirty-three repairs made on electrical appliances fourteen were made on the premises by the company's representative. Besides explaining the nature of the call and actually making minor repairs on electrical appliances, an inventory of the electrical equipment of each house was also taken and followed up later by regular salesmen.

The following excerpts from Miss Ward's report illustrate how some unknown complaints were uncovered and adjusted:

"One customer complained that there was a loud buzz in his radio set between 5:30 and 6 o'clock each evening. Upon investigation a loose connection was found on his neighbor's electric range. Upon tightening this connection the radio trouble was remedied."

"A great potential market for selling extra bulbs exists, for out of the 287 calls 172 customers were found to have empty sockets in their lighting fixtures. Upon inquiring the reason for these unfilled sockets the usual answer was that the housewife had neglected to keep extra bulbs on hand to refill the fixture when a bulb burned out or was broken. In one house six sockets were found empty. This particular customer ran a rooming house and removed the lamps to avoid high bills. On the other hand, only eight customers were found who kept extra lamps for immediate replacement."

These friendly and serviceable visits have not only helped improve public relations but they have also helped the company in ascertaining to what degree its service is used and pointed out possibilities for further development.

# Industrial Tractors Save Cost in One Year

### Under Severe Continuous Operating Conditions Seven Electric Battery Tractors Do Work of Twenty-eight Men at Less than Half the Former Cost

THE experience of the Chicago Warehouse & Terminal Company with electric industrial tractors should encourage power companies to develop the off-peak battery-charging load which this equipment provides. The Chicago Warehouse & Terminal Company operates 65 miles of tunnels under the center of Chicago's business district, through which freight is transferred from railroad terminals to many mercantile establishments. In addition to merchandise freight the tunnel system delivers coal to and removes ashes from many of these buildings.

There are five freight houses at which the cars of merchandise are raised by elevators to the freight-house floor and where the tractors are used for pulling the cars on and off the elevators and for spotting cars for loading or unloading. The cars, which run on a narrow-gage track, are of special design, 13 ft. long, 4½ ft. wide and 4½ ft. high, weighing 3,500 lb., with a capacity of 10,000 lb., and carrying an average load of 2,500 lb. Although the tractors operate on a level floor, the frequent moving of the heavily loaded cars constitutes very severe duty, as on an average each car is moved 60 ft. from the elevators and back again and seven tractors handle about 800 cars per day.

### PAY FOR SELVES IN LESS THAN A YEAR

The first tractor was purchased in October, 1919, and since that time eight machines have been operated, seven in regular service ten hours per day with one in reserve. Recently five additional tractors were purchased. All machines are the "Mercury" tractor, type "64M-Twin," made by the Mercury Manufacturing Company. Figures on the cost of operation as given here are taken from the records of the seven tractors in daily use.

Depreciation on the tractors is calculated on the basis of eight years' life, which is considered conservative. Batteries last three years and have an average trade-in value of 10 per cent at the end of that time. Operators take care of their own tractors to a large extent and are responsible for them. They put them on charge in the evening and

ELECTRIC BATTERY TRACTOR WITH TRAIN OPERATING IN CHICAGO TUNNEL SYSTEM

check up the condition of the battery in the morning. One man supervises the care of the tractors and receives the operators' reports. The average daily power consumption is 25 kw.-hr. for each tractor, and the total cost of operating the entire fleet is $18,962 per year. The cost per car handled is $0.0776 and per ton of merchandise is $0.0623.

Before purchasing the tractors cars were moved with gangs of laborers. To do the work the tractors are now doing would require twenty-eight men at a cost of $41,126 per year, or a cost of $0.1680 per car handled. Since the total annual cost of operating the tractors is $18,962, a saving of $22,164 per year has been made as compared with moving the cars by hand. The tractors, therefore, more than pay for themselves every year.

COST AND SAVINGS EFFECTED WITH BATTERY TRACTORS USED BY CHICAGO WAREHOUSE & TERMINAL COMPANY

| | |
|---|---|
| **Cost of Operation—Tractors** | |
| Depreciation, tractor $1,800.00 ÷ 8 years | $255.00 |
| Depreciation, battery ($755.00 — $75.50) ÷ 3 years | 226.50 |
| Average interest at 6 per cent on tractor* $= \frac{9}{8} \times \frac{\$1,800.00 \times 0.06}{2}$ | 60.75 |
| Average interest at 6 per cent on battery* $= \frac{4}{3} \times \frac{(\$755.00 - \$75.50) \times 0.06}{2}$ | 27.18 |
| Repairs and maintenance, chassis and battery | 175.00 |
| Tires, one set | 80.30 |
| Depreciation, charging equipment $= \frac{\$1,800.00 \div 15 \text{ years}}{7 \text{ tractors}}$ | 17.14 |
| Average interest, charging equipment,* at 6 per cent $= \frac{16}{15} \times \frac{\$1,800.00 \times 0.06}{2} \div 7$ tractors | 8.23 |
| Energy for charging, 25 kw.-hr. × $0.015 per kw.-hr. × 306 days | 114.75 |
| Operating labor, 10 hours at $0.53 per hour × 306 days | 1,621.80 |
| Supervision of charging and operation = $15.00 per week × 52 weeks ÷ 7 tractors | 111.43 |
| Total cost of operation of one tractor per year | $2,668.08 |
| Cost of operation of seven tractors per year = $2,668.08 × 7 | $18,676.56 |
| Depreciation and interest on extra chassis | 285.75 |
| Total cost per year of tractors | $18,962.31 |
| Cost per day of fleet, $18,962.31 ÷ 306 | 61.97 |
| Cost per day of one tractor, $61.97 ÷ 7 | 8.85 |
| Cost per car handled, $8.85 ÷ 114 | 0.0776 |
| Cost per ton merchandise, $8.85 ÷ 142 | 0.0623 |
| **Cost of Moving Cars by Gangs of Men** | |
| Labor, 28 men × 10 hours, at $0.48 × 306 days | $41,126.40 |
| Cost per car handled, $41,126.40 ÷ 244,800 cars | 0.1680 |
| **Saving Effected by Tractors** | |
| Hand method, cost per year | $41,126.40 |
| Mercury tractors, cost per year | 18,962.31 |
| Saving per year | $22,164.09 |
| Saving per car handled, $0.1680 — $0.0776 | 0.0904 |

*Allowing for interest earned by depreciation reserve.

## "Whys and Wherefores" of Boston Edison Radio

COMMENTING upon the Boston Edison company's reasons for establishing a radio broadcasting station President C. L. Edgar, in testifying before the Massachusetts Department of Public Utilities recently, said that originally it was planned to establish communication between plants and field forces, but that this had not worked out satisfactorily because of governmental limitations. The pioneer station was "WTAT," of 100 watts rating. This is a portable installation, still in use at community electric shows and in commercial broadcasting. It was sent to Oyster Bay, N. Y., during the late political campaign, being hired to broadcast an acceptance speech, and during the recent solar eclipse the company loaned the station for scientific purposes aboard the U. S. revenue cutter *Tampa*. This portable station cost about $11,000.

On October 1, 1924, station "WEEI," of 500 watts rating, was opened, and this cost about $80,000, including steel towers, building alterations and complete equipment. Mr. Edgar said that to December 31 the cost of operating this station had been $13,215. Income from rentals of its service amounted to $3,850, leaving a net cost of $9,365 for the initial period named.

The station was built (1) to yield a financial profit, (2) to advertise the company's service and developments, and (3) to develop good will toward the company. The broadcasting budget for 1925 is as follows: Salaries, including special payroll, $33,000; miscellaneous expenses, including traveling, $2,500; office supplies and postage, $2,500; goodwill broadcasting (Boston Edison "Big Brother" Club), $10,000; studio supplies, $2,000; total $50,000. Mr. Edgar said that there is no question that the station will earn more than $50,000 this year and that $19,330 in contracts was in sight before the end of January. Active solicitation of paid patronage forms a part of the conduct of affairs of the broadcasting installation. The work of the station is under the general direction of Joseph B. Groce, superintendent of the company's public relations bureau.

# Digest of Electrical Literature

## Hydro-Electric Development and Steam Equipment

*Problem of the Colorado River.*—WILLIAM F. DURAND.—Four problems of great magnitude would be solved by the proper development of the Colorado River—it would insure the security of the Imperial Valley, it would bring needed water to the cities of southern California, it would provide for a vast extension of fruitful land in the arid Southwest, and it would furnish about 600,000 hp. of electric power in a territory in which the demand is rapidly increasing. The author describes the physical conditions of the river and brings evidence to show that the creation of the necessary control works in the form of a dam from 650 ft. to 700 ft. high from bedrock and reservoir in the Boulder Canyon, impounding 25,000,000 acre-feet or more, can be financed by the sale of the power generated. Maps, views and a profile are presented in addition to the data on flow, floods, silt content and other information.—*Mechanical Engineering*, February, 1925.

*Pulverized Coal.*—Three articles on this subject are given in these two issues. They are: "A Review of Recent Applications to Steam Boilers," by Henry Kreisinger; "Test of Boilers at the Lake Shore Station in Cleveland," by John Wolff and "The Development of Pulverized Coal as a Boiler Fuel," by H. W. Brooks. The first two, given in the January issue, contain data obtained from a large number of test runs, most of them of twenty-four hours' duration or longer, at various plants and show the heat absorbed by the boilers running in several instances with efficiencies as high as 85 per cent and in one case reaching 87.1 per cent. Attention is called to the rapidity with which boilers can be brought into operation. The third paper, in the February issue, is a historical summary, showing that the firing of pulverized coal was attempted nearly a century ago, but that it did not emerge from the experimental stage for industrial use until about 1916 or for central-station use until 1920. This paper contains a list of prominent installations now in operation or contracted for.—*Mechanical Engineering*, January and February, 1925.

## Generation, Control, Switching and Protection

*Ventilation of Transformer Stations.*—F. SIEBER.—Data on ventilation of rooms as contained in mechanical handbooks are so complex and require so many assumptions that they cannot be applied readily for the ventilation of transformer stations. Basing his findings upon extensive practical experience, the author introduces a number of approximate values for all such factors—which previously had to be assumed—and rearranges the known ventilation formulas so as to be readily applicable to a particular purpose. It is not claimed that the results are mathematically exact, but they are fully satisfactory for practical use. With given dimensions of the building and known losses of the transformer, the formulas will give first the required air volume and then the minimum size of air intake and air exhaust to pass the air. Of particular value are the correction factors given for friction losses in various canal bends and air-intake gratings. The proper use of the formulas is illustrated by practical examples.—*Elektrotechnische Zeitschrift*, Jan. 22, 1925.

## Units, Measurements and Instruments

*Electric Harmonic Analyzer.*—J. D. COCKCROFT, R. T. COE, J. A. TYACKE and MILES WALKER.—The method described aims at analyzing wave forms up to at least the twenty-third harmonic and correctly to within 0.1 per cent of the fundamental. It was developed to avoid the laborious computations and inherently limited accuracy of the mechanical method starting from

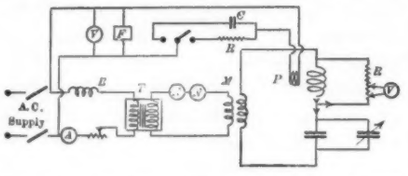



DIAGRAM OF CONNECTIONS FOR NEON-LAMP METHOD OF ANALYSIS

$B$ = Adjustable choke coil.
$T$ = Saturated transformer.
$N$ = Neon-filled glow lamp.
$M$ = Air-core mutual inductance.
$P$ = Pressure coil of dynamometer.
$C$ = Small-capacity condenser (0.1 $\mu$ F.)
$R$ = Non-inductive resistance (1,000 ohms).
$F$ = Frequency meter.
$V$ = Electrostatic voltmeter.

a graph of the wave, and the errors of the simple electrical resonance method, especially at the higher frequencies, due to other and not very remote frequencies. The complex wave to be analyzed is sent through one coil of a dynamometer, and a pure wave of fixed magnitude and of frequency equal to that of one of the harmonics is sent through the other. By suitable adjustment of the phase relation the deflection becomes directly proportional to the amplitude of the harmonic in question, the average torque throughout the cycle due to all other components being zero. The difficulties in practice are to obtain a perfectly sinusoidal analyzing current and to maintain it at the exact frequency of the harmonic, which varies if the speed of the machine fluctuates. If the speed is very steady a self-oscillating three-electrode valve circuit may be used. Otherwise a satisfactory approximation is obtained by applying timed impulses to a tuned filter circuit, using either a direct-current source and a synchronously driven commutator or peaks from the alternating-current circuit itself. For the latter the primary of a saturated transformer is excited through a choke coil. The secondary circuit is completed through several neon-filled glow lamps and the primary of an air-core coupling with the oscillatory circuit, of which latter circuit the coil of the dynamometer is a portion. The authors take up various features affecting the design of dynamometer and circuits and give examples of results achieved by their method. Possible sources of error are investigated and their magnitude determined. The mathematical aspects are treated separately in an appendix, which also contains an apparently exhaustive bibliography.—*Journal of Institution of Electrical Engineers (England)*, January, 1925.

*Investigations on High-Voltage Impulse Testing.*—L. BINDER.—Tests are reported which were made to determine the shape and the length of traveling waves on lines of various lengths. It was found that for lines of 30 m. or less the distribution of voltage is totally different from the previous calculation, assuming rectangular wave form. If the lines are only a few yards in length, no waves at all will be formed. The explanation why Hertzian oscillations have been observed on much shorter circuits seems to be that in the latter case the igniting spark had always a great surplus of voltage. Subjecting the spark gap to radium emanation made it possible to avoid a delay in discharge. The author succeeded in this manner in obtaining impulse discharges of as short a duration as $3 \times 10^{-8}$ seconds. These discharges were so faint as to be barely visible, but were audible as a slight crack. It was further established that the length of lines has a material influence upon the action of impulse discharges. With a short line between impulse generator and tested insulator the latter can be subjected to a higher voltage than with a longer line, because in the first case the condenser furnishes the voltage directly with but little drooping characteristic, while in the latter case the intervening line has to be charged first and furnishes, by its discharge, the source of supply, which by that time has already a flatter characteristic.—*Elektrotechnische Zeitschrift*, Jan. 29, 1925.

## Transmission, Substations and Distribution

*Economical Study of Overhead High-Tension Distribution Lines.*—Y. KAKAMI and Y. IWABUCHI.—The authors discuss the economical relation between the power load and the conductor size. They take up a specific case, getting for this unit costs covering materials and labor. From this figure they determine what the annual income should be.—*Journal of Institute of Electrical Engineers of Japan*, No. 437.

*Microscopic Observation of Oil Punctures.*—E. OELSCHLAGER.—The author made a very small container out of clear celluloid, holding only about a thimbleful of oil, and placed it on the stage of a microscope. Through the sides of the little tank two copper electrodes were inserted into the oil, where they formed a gap with ¼ mm. distance between them. Applying gradually rising voltage, peculiar phenomena were

observed, which depended upon the voltage, the current (direct or alternating) and the quality of the oil. With a magnification of fifty to a hundred diameters it was found that every oil, even the best filtered, contained a large amount of foreign particles in the shape of fine fibers and that these fibers are attracted into the electrostatic field of the gap. Here they set up characteristic dancing motions, to which are added whirls of the oil itself. If the oil is wet, it will be found that these foreign particles ooze out bubbles of water vapor. To study the various motions in the oil the author added to it a small amount of fernseed (lycopodium). Applying direct current, a steady stream from the cathode to the anode was observed close to the electrode, and the reverse farther away from them. If the current was suddenly reversed, the motion was taken up the other way too. The gap being only 0.25 mm., stresses in the oil of as high as 180 kv. per centimeter were reached with only 4,000 volts applied to the electrodes. These interesting phenomena had been recorded by attaching a motion-picture camera at the eyepiece of the microscope and using an arc lamp as illuminator.—*Siemens Zeitschrift*, January, 1925.

## Illumination

*Traffic Control System*—C. A. B. HALVORSON; *Connection Between Astronomical and Practical Photometry*—CHARLES FABRY; *Survey of Street-Lighting Practice in the United States*—J. FRANKLIN MEYER, and *Some Results of the Columbus Street-Lighting Tests*—F. C. CALDWELL.—Abstracts of these papers and the discussions on them may be found in the ELECTRICAL WORLD report of the I. E. S. convention at Briarcliff Manor, Nov. 8, 1924, on page 1017.—*Transactions of the I. E. S.*, January, 1925.

## Electrophysics, Electrochemistry and Batteries

*Current Supply for Small Telephone Central Stations.*—B. STERNBERG.—The customary installation of two storage batteries, of which one is discharged while the other one is charged, entails a number of disadvantages in small telephone central stations, particularly because such relatively large batteries do not, as a rule, get adequate supervision. The operation of the signal lamps on the switchboard, usually 24-volt bulbs, requires by far the largest output of the batteries. The author is of the opinion that it is not at all necessary to cling to the old telephone practice, but that it is perfectly feasible to feed the signal lamps from the local alternating-current supply, interposing a small transformer. In addition to furnishing 24 volts for the lamp, a tap on this same transformer could furnish 40 volts for the bell ringing. Direct current would only be needed for the transmitter circuits, which would call for a very small storage battery. By arranging this battery to float on a small rectifier set discharge can take place during charging, rendering a second battery unnecessary. With modern central-station equipment a breakdown of the telephone service due to a failure in the alternating-current supply is a very remote possibility, but in an emergency the existing small storage battery will be able to supply all the needed current for a short time.—*Elektrotechnische Zeitschrift*, Jan. 15, 1925.

*Cleaning Cans with Electricity.*—The salvaging of containers for paints, varnishes, inks, etc., so that they can again be used has long been a problem. By an electrolytic method using a high current (1,000 amp.) the film is loosened and floats off.—*Chemical and Metallurgical Engineering*, Feb. 16, 1925.

*Bipolar Cells for Electrolysis of Water.*—F. PETZ.—For the electrolytic generation of hydrogen and oxygen on a large manufacturing scale bipolar dissociation cells for 110 volts or more are much preferable to a large number of individual cells connected in series. Such cells are known as filter-press type bipolar cells. Their chief disadvantage is the necessity of a careful electrical insulation between the electrodes of adjacent pairs. Wood, ebony and rubber are used for this purpose, but their life is very limited. The author uses instead a large vat made of concrete reinforced with imbedded structural steel. These steel reinforcements are the essential part of the new cell construction. If a current introduced by electrodes passes an electrolyte and finds therein metallic conductors, it will go through these, but in doing so will discharge ions at the surface of the metal. If the metal can resist the chemical action of these ions, the metal will take on an electric charge (polarization) which will react against the charging current like the counter electromotive force of a galvanic cell. The flow of current through the metal will therefore be impeded, and it will prefer to flow through the electrolyte, although this is a much poorer conductor. Based on this unique principle, the author has built very large decomposition vats holding as many as 250 electrodes 2 m. x 1 m. in size. Two such vats in series can operate on 550-volt direct current, producing about 1½ cu.m. of gas at a consumption of between 4 kw.-hr. and 6½ kw.-hr.—*Elektrotechnische Zeitschrift*, Jan. 8, 1925.

## Traction

*New Electric Locomotive for New York Central Railroad.*—In anticipation of the electrification of the West Side freight tracks in New York City the road has placed orders for seven 100-ton switching and two 170-ton freight locomotives. These are described and general dimensions given.—*Railway Review*, Jan. 17, 1925, and *Railway Age*, Jan. 17, 1925.

*Phase-Transforming Locomotive.*—L. VEREBELY.—The main feature of this new traction system is a single-phase, 50-cycle, 15,000-volt current supply, which is changed on the locomotive into three-phase current feeding three-phase induction motors, operating the driving wheels with triangle-rod mechanism. The change-over from single-phase into three-phase is accomplished with a new single-stator machine running at synchronous speed. For a two-pole type and 50 cycles a constant speed of 3,000 r.p.m. is maintained. A directly connected special exciter unit allows an economic regulation of the three-phase current obtained for the traction motors within the limits of 350 volts and 600 volts. Of great importance is the fact that the winding on this special synchronous converter is so dimensioned that its short-circuit current is less than the full-load operating current, so that an unusually easy start of the unit, with a minimum of reaction upon the power house, is insured. The machine is furthermore self-synchronizing and can be started up again within a few seconds if it should fall out of step. With proper adjustment of the excitation, the converter operates unity or even with advancing power factor. Regeneration of current on down grades takes place automatically and saves wear on brakes and rails. A 2,000-kw. test locomotive of this type has been built and is in successful operation in Hungary.—*Elektrotechnische Zeitschrift*, Jan. 8, 1925.

## Telegraphy, Telephony, Radio and Batteries

*Tests at Leafield Arc Station.*—E. H. SHAUGHNESSY.—The annual address of the chairman of the Wireless Section of the Institution of Electrical Engineers contains, in addition to a general review, data on the coupled circuit of a 250-kw. arc station which is now operated without causing "mush," so that it is possible to receive broadcasting in close proximity to it without trouble. The chief parts are briefly described. Tests on various woods for insulations show results that strongly favor American whitewood, 1-in. x 1-in. x 4-in. samples having withstood prolonged application of 35,000 volts at 43 kilocycles between the ends. The field strength under the transmitting aërial was investigated with an exploring device using a neon tube. Method and results are given.—*Journal of the Institute of Electrical Engineers (England)*, December, 1924.

*Recent Developments in Vacuum-Tube Transmitters.*—B. R. CUMMINGS.—This paper describes a number of vacuum-tube transmitters which have been developed and built during the past year both for commercial use and for various governmental departments. The largest, rated at 20 kw., get their plate voltage from a three-phase supply and kenotron rectifier unit providing 15,000 volts direct current with a ripple of less than 0.1 per cent. The reasons for adopting the present circuits are discussed. The article is abundantly illustrated.—*Proceedings of Institute of Radio Engineers*, February, 1925.

## Miscellaneous

*Some Developments in the Electrical Industry During* 1924.—JOHN LISTON.—This fifty-page article contains brief descriptions with illustrations and in some instances data of so many devices and machines, ranging from 65,000-kva. turbines to fused quartz, that a résumé is impossible in a limited space. It is a convenient source of brief information on new things.—*General Electric Review*, January, 1925.

# New Books

## Alternating-Current Rectification

By L. B. W. Jolley. New York: John Wiley & Sons, Inc. 352 pages, illustrated.

This book treats thoroughly of all modern developments in alternating-current rectification. It is a new and welcome addition to engineering literature and covers a new and important branch of the art. Descriptive matter of all forms of rectification equipment is included, and in addition the author gives the fundamental principles underlying its behavior and states the quantitative relations existing. Mechanical rectification, gaseous rectification, thermionic rectification and liquid rectification in all their practical aspects are treated, and important chapters are devoted to vacuum tubes, wireless rectification and voltage regulation and measurement. A very valuable feature of the book is a well-selected bibliography at the end of each chapter.

The renewed interest in the mercury rectifier for large-power purposes, the extensive use of vacuum tubes and other new developments in rectification make this book extremely timely and valuable.

## Automatic Telephone Systems

By William Aitken. Vol. III. New York: D. Van Nostrand Company. 339 pages, illustrated.

The author has succeeded to an unusual degree in maintaining a high standard of excellence in his three volumes on automatic telephone systems. He is to be commended for his painstaking care in presenting so clearly the details of all the important ones now in general use. Volume III treats of automatic systems in large multi-office areas, semi-automatic operation, metering telephone calls, toll-line work, etc. The operations are indicated step by step, and the reader should therefore experience little difficulty in obtaining a thorough understanding of the subject. It is seldom that one finds complicated circuit diagrams so simply presented. In addition to the large number of small diagrams, the author has included in this volume about twenty-five large folded diagrams of the more elaborate switching schemes drawn to a sufficiently large scale to be easily followed. The book will appeal particularly to those interested in present automatic practice.

H. M. T.

## Industrial Electricity

By William H. Timbie. New York: John Wiley & Sons, Inc. 735 pages, 469 illustrations. Price, $3.50.

To meet increasing demand from technical schools and electrical workers for a text covering the important principles of electrical science as applied to modern industry is the object of this book. The author explains how direct-current electricity is generated, transmitted and utilized, and the volume should afford an adequate foundation for further study in the application of alternating current to modern practice. Some of the book's features are: (1) It presents in a thorough manner the most important principles of electrical science in understandable language; (2) it applies present-day practice in the various branches of the electrical industry; (3) it takes up fully the magnetic circuit; (4) it presents in a simplified but practical form the operating characteristics of direct-current generation and motors; (5) it includes a short treatise on the electrostatic circuit and thermionic emission, and (6) it presents more than a thousand typical examples and practical problems.

## Elements of Electrical Engineering

By A. L. Cook. New York: John Wiley & Sons, Inc. 568 pages, illustrated.

This is a fundamental textbook in direct-current and alternating-circuits and machines which has been developed at Pratt Institute. In a series of short chapters well illustrated and containing a list of good problems the author covers the usual field of textbook material for a first course in electrical engineering. The presentation is good, if brief, and principles are accented. Chapters on control and switching equipment, wiring and transmission add to the scope and value of the work. Nothing very new or original is looked for in a text of this character, but the book is certain to find a wide use, even though very similar to existing texts, if past experiences are valid, for, other things being equal, teachers seek the latest text published.

## Electrical Circuits and Machinery

Vol. II. Alternating Currents. By John H. Morecroft and F. W. Hehre. New York: John Wiley & Sons. 427 pages, illustrated.

A second volume of a text on electrical circuits and machinery which deals with alternating currents and certain alternating-current machines. The authors have devoted a great deal of space to fundamental circuit principles and the relations existing in polyphase circuits and transformations. The treatment is thorough, and the material in the problems following each chapter is well chosen to illustrate the principles.

Vectors and vector relations are clearly explained, and the trigonometric function is used instead of the complex variable for making calculations. The treatment of transients and harmonics is rather meager, as is the space devoted to the parallel operation of alternators. The alternator, synchronous motor, induction motor and commutator motor are treated in a fundamental manner.

The chapter on armature reaction is complete and good, and an adequate treatment of meters is included. The book would be better had a chapter on dielectric phenomena been included. Chapters on rectifiers and transmission are contained in the volume. The book will find a favorable reception from many teachers because of its clearness, scope and treatment of fundamental principles only.

# Book Notes

**Superpower.** By L. T. Beman. New York: H. W. Wilson Company. 89 pages.

A bibliography of about 150 articles on superpower that have appeared during the last four years in various publications. Articles by W. S. Murray, Herbert Hoover, E. A. Holbrook, M. L. Cooke, Gifford Pinchot and Sir Adam Beck are published in full or in part.

**La Soudure Electrique à l'Arc Metallique.** By S. Frimandeau. Paris: Gauthier-Villars et Cie. 136 pages, 80 illustrations.

This is a practical handbook for an operator using the metallic electrode method for electric welding. The narrow scope of the book permits the author to go into great detail and to give a large number of practical data on the subject. In the last chapter very valuable and little-known suggestions are given for X-ray examinations of various welds.

**Electrolytic Rectifier.** By N. A. deBruyne. New York and London: Isaac Pitman & Sons, 75 pages, 23 illustrations. Price, $1.

As far as the reviewer has been able to determine this is the first book on electrolytic rectifiers that has been published. Although the book is rather short, the author gives a very clear and concise explanation of the fundamentals and characteristics of this type of rectifier. A chapter showing how to make and use a rectifier for charging storage batteries from an alternating-current source is included. Another chapter is devoted to electrolytic lightning arresters.

**Reconnecting Induction Motors.** Second edition. By A. M. Dudley. New York: McGraw-Hill Book Company. 360 pages, illustrated.

The second edition of this popular book on windings and connections for induction motors retains all the former material and in addition has five new chapters. These deal with single-phase windings, rotor windings, distribution factor, magnetic balance and windings with unequal coil groupings.

**Technical Mechanics.** Fifth Edition. By E. R. Maurer and R. J. Roark. New York: John Wiley & Sons, Inc. 363 pages, illustrated.

This well-known and popular textbook has been completely rewritten by the authors. The main changes have been to add new illustrative matter and problems whereby the principles can be applied to more modern engineering problems. A rearrangement of contents and different treatments of text matter make it possible to teach the book to classes which devote varying amounts of time to the study of mechanics.

# Books Received

**Principles of Transmission in Telephony.** by M. P. Weinbach. New York: Macmillan Company. 303 pages, illustrated.

**Electrical Design of Overhead Power Transmission Lines.** By William F. Taylor and R. E. Neale. New York: D. Van Nostrand Company. 266 pages, illustrated. Price, $6.

**A Text Book of Metallography.** By Gustave Tammann. Translated from the third German edition, by R. S. Dean and L. G. Swenson. New York: The Chemical Catalog Company. 388 pages, illustrated. Price, $6.

**Profitable Science in Industry.** By Dwight T. Farnham, James S. Hall, R. W. King and H. E. Howe. New York: Macmillan Company. 291 pages, illustrated. Price, $3.50.

**Illuminating Engineering.** Prepared by a staff of specialists. Editors: Francis E. Cady and Henry B. Dates. New York: John Wiley & Sons, Inc. 486 pages, illustrated. $5.

**How to Build Up Furnace Efficiency.** By Joseph W. Hays. Michigan City: Joseph W. Hays & Associates. 534 pages, illustrated. Price, Molloy binding, $3.50; cloth, $3; flexible waterproof binding, $2.75.

**Railway Electrification.** By H. F. Trewman. London: Sir Isaac Pitman & Sons, Ltd. 243 pages, illustrated.

**Einstein's Theory of Relativity.** By Max Born. Translated by Henry L. Brose, New York: E. P. Dutton & Company. 293 pages, illustrated. $5.

**Connecting and Testing Direct-Current Machines.** By F. A. Annett and A. C. Coe. New York: McGraw-Hill Book Company. 237 pages, illustrated. $2.50.

# News of the Industry

## Weeks Issues Canal Permit

### Chicago May Withdraw 8,500 Sec.-Ft. from Lake Michigan Under Stipulated Conditions

THE long dispute over lowering lake levels which has been waged between the Chicago Sanitary District and states other than Illinois that border on the Great Lakes, and in which international relations and power development are both intimately concerned, culminated on Friday of last week in the issuance to the district by Secretary Weeks of a conditional permit to withdraw 8,500 cu.ft. a second from Lake Michigan up to December 31, 1929. The district had applied for 10,000 ft. a second.

The conditions stipulated, on the recommendation of the army engineers, contemplate reduction of Chicago's withdrawals from the lake on a progressive scale to 4,164 cu.ft. a second or less by 1935. Sewage disposal projects required by the district to this end involve an estimated cost of $54,192,000, to cover which the district will need additional bonding power.

A further stipulation contemplates future general plans to restore lake levels, Chicago to agree to pay its share of the cost of such works and to post a good-faith bond of $1,000,000. Other conditions are that within six months a project for metering at least 90 per cent of the water service of the city of Chicago shall be adopted, to be put in execution at a rate of 10 per cent a year, and that the entire program shall be under the supervision of the United States district engineer at Chicago. The permit is revocable at the will of the Secretary of War and subject to any action Congress may take.

Secretary Weeks' decision followed action of the Supreme Court upholding his right to control diversion of water from the Great Lakes under his authority to control navigable waters.

## Insull to Buy Barstow New England Properties

The Vermont Hydro-Electric Corporation, the Pittsford Power Company and the Rutland Railway, Light & Power Company, all owned by the General Gas & Electric Corporation of New York, holding company for the W. S. Barstow properties, and hitherto managed by the W. S. Barstow Management Association, are about to pass to the ownership of the interests headed by Samuel Insull of Chicago. The three properties first named, with headquarters at Rutland, Vt., serve, directly or through the sale of energy to other companies, about a score of cities and towns in Vermont, the lines of the Vermont Hydro Electric Corporation reaching also to Claremont, N. H.

These General Gas & Electric properties will, it is announced, be consolidated with the New England properties already controlled by the Insull interests through the Middle West Utilities Company of Chicago. Chief among the latter is the Twin State Gas & Electric Company, serving from Brattleboro, Vt., about thirty places in that state, New Hampshire and New York. A subsidiary of the Twin State is the Berwick & Salmon Falls Electric Company of South Berwick, Me.

The price to be paid for the common stock of the Barstow properties is understood to be about $2,000,000. They will be managed from the offices of the Twin State Gas & Electric Company in Boston. The Hortonia Power Company of Brandon, Vt., which owns eight water-power and three auxiliary steam plants and has an office in Rutland, is not included in the deal.

## Philadelphia Railway Attacks Conowingo

### Declares Project Would Drain Resources of Philadelphia Electric Company—Calls Present Rates Excessive and Asks Commission to Investigate

FILING of five applications with the Pennsylvania Public Service Commission by the Philadelphia Electric Company and the Susquehanna Power Company asking approval of their development plans for the Conowingo (Md.) hydro-electric project has brought forth a bitter and apparently unexpected attack on the whole undertaking from the Philadelphia Rapid Transit Company, which bases its action on the assertion that it uses about 20 per cent of the output of the Philadelphia Electric Company in the operation of the street-railway system of the city, two-thirds of the energy for this system being purchased from the other utility. The Philadelphia Rapid Transit Company filed its first brief in this matter on March 9 and another one on March 10. In these documents it maintains that the present rates of the Philadelphia Electric Company are excessive and discriminatory and asks for their reduction. The Rapid Transit company says that in 1923 the Electric company earned 20 per cent gross income on the estimated original cost of its properties, whereas the Public Service Commission in 1916 approved a stipulation that the power company's earnings should not exceed its bond interest and 7 per cent on its then outstanding capital stock.

The Rapid Transit company says further that only the present strong financial position of the Philadelphia Electric Company permits the latter to embark on the fifty-two-million-dollar Conowingo development and assume an annual charge of $4,580,000, regardless of the amount of energy produced or its availability for use in Philadelphia. The railway company's brief maintains that the Electric company is to pay an excessive price for the site, that Drexel & Company, who held the options on the Conowingo site and are the fiscal agents for the undertaking, are to receive excessive promotion commissions reaching $6,000,000 or $7,000,000, and that Stone & Webster, who, it is understood, are to build the plant, will make excessive profits. The second brief of the Rapid Transit company makes request for an audit of the power company's books and for detailed information covering eight separate points connected with the financial and engineering aspects of the power company's business, its production and operating costs, the brief saying that these data are "necessary to permit the Philadelphia Rapid Transit Company to check the estimate of savings of $800,000 per annum due to the introduction of Conowingo power." The petition states that the Conowingo development may so drain the financial resources of the Philadelphia Electric Company as to jeopardize its ability to give service and that if the project costs more than estimated there will result a financial loss to the Philadelphia Electric Company. It also says that while the contractors, engineers and fiscal agents are assured of large profits, the Electric company assumes all the responsibility for loss.

Of the five applications filed with the commission by the Philadelphia Electric Company and the Susquehanna Power Company, the first is a master contract between these two companies and others. Another covers transmission-line leases, another covers a pool agreement, still another an operating agreement, and the last one covers a securities agreement whereby the capital stock of the Susquehanna Power Company will be acquired by the Philadelphia Electric Company.

#### HEARING ON MARCH 27

The commission has fixed March 27 in Philadelphia as the date and place for the next hearing on the project. At this hearing the Maryland Public Service Commission and a representative of the Federal Power Commission will sit with the Pennsylvania commission. At a preliminary meeting O. C. Merrill, executive secretary of the Federal Power Commission, was elected chairman of the tri-commission, Harold E. West (chairman of the Maryland body) and W. D. B. Ainey (chairman of the Pennsylvania body) becoming vice-chairmen.

Officials of the Philadelphia Electric Company are reported to welcome the hearing. They have studied the Conowingo project with great care, and their past record of service is such

that they feel proof will be ample that they know how to operate their business for the benefit of the public. They feel confident of establishing their estimate that the Conowingo development will result in a saving of at least $800,000 a year.

Many reports are heard in Philadelphia that the Rapid Transit attack is merely an indication of the revival of the Mitten-Stotesbury feud, with the Conowingo project serving as the excuse for the attacks. Thomas E. Mitten is chairman of the executive committee of the railway company, and E. T. Stotesbury is associated with Drexel & Company.

Another aspect of the somewhat complicated situation is that presented by the attitude of the State of Maryland and certain individual citizens and associations thereof who oppose the project. Governor Ritchie of that state has drawn up reservations to protect its rights which he thinks can be made without delaying the enterprise. Clarence W. Miles, people's counsel before the Maryland commission, who was an advocate of tri-commission conferences, insists that he will have nothing to do with them unless they are public.

## Portland Electric Will Spend $2,000,000 for Construction

With a budget for 1925 totaling about $2,000,000, the Portland (Ore.) Electric Power Company has got its development work for this year well under way. The largest single item is for a 60,000-volt transmission line from Oregon City to Salem, Ore., via Newberg, involving the reconstruction of 20 miles of the present line between Oregon City and Newberg and the building of 30 miles of new line from there to Salem. This line, which will be placed on single wooden poles with triangular construction, is the second transmission line between the terminal points, but will follow a different route and tap a new territory.

A second important addition to the transmission system provided for in the budget is the construction of the second circuit from the new Oak Grove plant to Cazadero, Ore., about 18 miles. This circuit will be placed on steel towers installed as part of the Oak Grove development, and though spaced for 115,000 volts, will be operated for the present at 60,000 volts.

The budget further provides for a new subway from Station "L," the principal steam plant of the company, to Sullivan's Gulch in Portland, a distance of about 6,500 ft. In this subway will be laid two 11,000-volt cables, and it is planned to continue this underground construction in future years from the Gulch to the Knott Street substation. Other minor additions to the transmission system are projected, as are also numerous small items in the distribution group.

No additional generating capacity is planned for 1925, though a number of relatively small improvements will be made at several of the plants and substations. A small allotment is made in the budget for experimental and preliminary development work on the company's holdings on the Clackamas.

## Oklahoma Men Assemble

### Interference with Radio Provides a Constructive Topic—Public Relations and Radical Propaganda

THE seventh annual convention of the Oklahoma Utilities Association at Oklahoma City, March 10, 11 and 12, broke all previous records for attendance with more than 600 utility managers and employees present, including 150 women. At a luncheon of public relations and advertising directors steps were taken to organize a public relations section of the association to hold meetings several times a year and formulate plans for concerted and systematic action along these lines. Public relations directors from other states attended the luncheon. The women's public utility information committee of Oklahoma also held a luncheon and meeting to outline extension of its work.

Among the speakers of national reputation in the industry were W. S. Vivian of Chicago, director public relations Middle West Utilities Company; E. Bentley Hamilton, Peoria, Ill., assistant general attorney Missouri Power & Light Company; J. F. Owens, Oklahoma City, president Southwestern Geographic Division, N.E.L.A.; W. R. G. Baker, Schenectady, N. Y., engineer radio department, General Elecric Company, and Frank R. Coates, New York, director Cities Service Company.

The light and power companies of the United States should voluntarily take up the problem of eliminating so far as possible interference by electric transmission lines with radio reception if they would retain the good will of the public, Mr. Baker declared. He predicted that unless this is done politicians will use this matter of interference as a political slogan on which to ride into office and cause the light and power companies much trouble. With the aid of lantern slides he showed how to remedy interference from electric and telephone lines.

In an address entitled "The Power of Leadership" J. B. Wootan pointed out the dangers of paternalism and radicalism. He declared that radical propaganda is insidious and hard to combat, since it is harder to kill a false idea than to kill a man.

That public relations work is just putting the human quality into public utility service and practicing the golden rule was pointed out by W. S. Vivian, who declared that every public relations department should operate according to a definite program and should first "sell" the company to its employees, then to its customer-owners, its patrons and the public.

## Fitkin Interests Add to Holdings in North and South

To the holdings of the National Public Service Corporation, recently organized, as told in the ELECTRICAL WORLD, by the A. E. Fitkin interests as a successor to the Jersey Central Power & Light Company, their previous holding concern, have been added the Monmouth Lighting Company of Keyport, N. J. (formerly owned by the American Electric Power Company, Philadelphia), and the Shore Lighting Company, operating in territory south of Asbury Park, as well as several utilities not concerned with light and power. This makes a total of seven New Jersey electric plants recently taken over by the Fitkin company (see ELECTRICAL WORLD for February 28, page 472).

In Florida the National Public Service Corporation is taking over the Florida Power Company of Ocala, a hydro-electric company, which will be connected by high-tension transmission lines with the Pinellas County Power Company of St. Petersburg. The latter is a subsidiary of the Tidewater Power Company of Wilmington, N. C., now owned by the Jersey Central Power & Light.

## Milwaukee Service-at-Cost Contract Goes to Voters

With but little debate, the Milwaukee Common Council voted, twenty-one to four, last week in favor of the ordinance containing the proposed service-at-cost contract to be entered into between the city of Milwaukee and the Milwaukee Electric Railway & Light Company covering the joint management of the company's electric railway, light, power, heat and bus properties in the metropolitan area, which are valued at $56,000,000. (See ELECTRICAL WORLD, October 4, 1924, page 754.) The measure will be submitted to the stockholders of the Milwaukee company on March 27 and if approved by them will be submitted to a vote of the people at the spring election on April 7. If the contract is approved at that time, it will become effective on July 1, provided that it bears the approval of the Wisconsin Railroad Commission and the North American Company. Their favorable action is considered certain. The contract will run for a period of ten years, with the privilege of cancellation at the end of eight years by a majority vote of the people. It will be automatically renewed every ten years, during which time the city may purchase the properties if the people vote in favor of municipal ownership.

## General Electric Security Owners Free from Inquiry

In a letter to its stockholders the General Electric Company has made public the opinion of its attorneys that the Federal Trade Commission, under the resolution adopted in the United States Senate on February 9, has no power to inquire into the affairs of any individual stockholder or other security holder. The general purpose of the Senate resolution was to determine the extent of the General Electric's control of power companies and to ascertain if it is operating in violation of anti-trust laws.

The letter, which is signed by Owen D. Young, chairman of the board, and Gerard Swope, president, says:

"The General Electric Company asked the advice of counsel as to the scope of the inquiry and the power of the Federal Trade Commission under

such resolution. Our counsel has advised that in their opinion the Federal Trade Commission, notwithstanding the language of the resolution, is authorized by the terms of the Federal Trade Commission act to inquire into alleged violation of the anti-trust laws by the corporation and its subsidiaries only and has no power to inquire into the affairs of any individual stockholder or security holder.

"The company, in accordance with its usual practice, intends to make full disclosures of all facts which relate to any alleged violations of the anti-trust laws. The company issues this statement to its stockholders in order that they may be advised of the resolution, of the opinion of our counsel and of the course which the company intends to pursue."

## Arizona Sticks to Her Guns

### State Senate Again Rejects Colorado River Compact—Compromise Plan Proposed

A RESOLUTION proposing ratification of the Colorado River compact as accepted by the six other basin states has been defeated by a vote of eleven to seven in the Senate of the Arizona Legislature. With the defeat of the resolution three others were withdrawn and a resolution already adopted by the House of Representatives was taken under consideration. The resolution as passed by the House provides for ratification of the compact if representatives of Arizona, California and Nevada can agree to a distribution of the water allotted to the lower basin that will be acceptable to a special session of the Arizona Legislature.

## Proposed that Six States Shall Go Ahead Under Compact

Sponsored by Colorado, a movement is under way in that state, California, Nevada, New Mexico, Utah and Wyoming which provides for re-ratification of the Colorado River compact in a way to make it effective upon approval by six out of the seven states involved, Arizona being the seventh. A resolution already passed by the Colorado and Wyoming Legislatures provides "that the provisions of the first paragraph of Article 11 of the Colorado River compact, making said compact effective when it shall have been approved by the Legislature of each of the signatory states, are hereby waived and said compact shall become binding and obligatory upon the State of Colorado and upon the other signatory states which have ratified or may hereafter ratify it whenever at least six of the signatory states shall have consented thereto and the Congress of the United States shall have given its consent and approval, provided, however, that this resolution shall be of no force or effect until this or a similar act or resolution shall have been passed or adopted by the Legislatures of the States of California, Nevada, New Mexico, Utah and Wyoming." This resolution has been sent to the California, Nevada, New Mexico and Utah Legislatures.

## New Black River Plant

The Power Corporation of New York, which controls the Northern New York Utilities, with hydro-electric plants on the Black, Beaver and Oswegatchie Rivers, is understood to have under way negotiations with the International Paper Company for the purchase of three paper mills with power rights at Glen Park and Brownville, on the river first named. The Power Corporation is said to contemplate constructing there one of the largest hydro-electric plants in the state. The plan is to dig a great canal diverting the course of the entire Black River from the mill at Glen Park to the mill at Brownville. The water will be taken into the canal at the upper mill and will be emptied back into the present course of the river at the lower one.

This will result in a 90-ft. to 97-ft. head, capable of developing 25,000 hp. to 30,000 hp. The power plant will be constructed near the point where the canal is emptied back into the river. The canal will be carried over the land now owned by the International Paper Company on the south side of the river.

## Hetch Hetchy Power on Sale on April 1

At a meeting of the Board of Supervisors of San Francisco on March 9 the clerk of the board was instructed to solicit offers for the purchase of the whole or any part of the power that will be available from the Moccasin power house on the Hetch Hetchy development on April 1 by any municipality, municipal water district or irrigation district. Delivery is to be made at any point on the Hetch Hetchy transmission line at the voltage and frequency of that line, and any bids are to be in the hands of the Supervisors not later than March 30 with a statement of the plans and arrangements which the bidder contemplates following in taking delivery of energy. This action follows the veto by the Mayor of a resolution passed by the board the week previous (see ELECTRICAL WORLD for February 28, page 472), which sanctioned disposal of the power through an agency arrangement with one of the private corporations serving the city, provided that no power so contracted for could be used for resale.

The Board of Supervisors' endeavor is to find a market for Hetch Hetchy power in the interim between the completion of the power plant and the time that it will take the Railroad Commission to complete valuations of the two private distribution systems in the city and the people to decide what shall ultimately be done with the power.

## Public Moneys Advanced to Ontario Hydro Commission

A statement of the moneys advanced by the Province of Ontario to the Hydro-Electric Power Commission for power development, which S. S. Wyer, the United States engineer whose report to the Smithsonian Institution at Washington on the Ontario system caused considerable comment recently, is understood to have received from official Ontario sources, has been published in Canadian papers as follows:

Total advances from 1917 to 1924 (inclusive) are given as $138,454,638.95. For the same period total operating capital is given as $129,420,515.66, and total sinking fund as $3,902,495.77.

Regarding the Queenston-Chippawa development and the Thunder Bay and Central Ontario system, the statement says:

"Thunder Bay System.—The total investment in this system as at October 31, 1924, is $8,573,648.18, of which $8,215,246.87 is in operation. This plant is not yet in full operation and sinking fund has not yet been applied.

"Queenston-Chippawa Development.—The total investment in this plant at October 31, 1924, is $73,117,043.89, of which $69,481,762.28 is in operation. Sinking fund at 1 per cent, approximately $670,000, will be charged for the first time in the fiscal year ending October 31, 1925.

"Central Ontario System.—The total investment as at October 31, 1924, is $14,115,000, of which $13,609,150 is in operation. Sinking fund will not be charged on this system until 1926, when the bond issue of the Ontario government becomes due and will probably be refunded by a bond issue of the Hydro-Electric Power Commission upon which sinking fund will apply.

"Sinking fund is being charged on only that portion of this system relating to pulp mill at Campbellford and Bruton township pulp limits."

## Muscle Shoals Commission to Be Appointed Soon

The President is expected to name promptly a commission to make recommendations as to future operations at Muscle Shoals. Since there is a balance of $150,000 remaining of the appropriation in the national defense act, this amount will be available for the prosecution of the study. Recommendations for the technical member of the commission are being considered by Secretary of Commerce Hoover. In that connection there has been discussion, among others, of the names of H. C. Parmelee, the editor of *Chemical and Metallurgical Engineering;* Alfred H. White, professor of chemical engineering at the University of Michigan, and Harry A. Curtis, professor of chemical engineering at Yale University. An effort also is being made to bring about the appointment of an electrical engineer to the commission. It is possible that the President may enlarge the commission to five members, but even should only three members be appointed, it is pointed out, an electrical engineer could be found who would qualify as "a representative citizen familiar with the Muscle Shoals enterprise."

The administration is understood to be particularly desirous of securing a commission of outstanding men who have not been active participants in any of the controversies which have raged around Muscle Shoals. This has eliminated some of the men who have a very comprehensive knowledge of the situation.

# Penrose Analyzes Giant Power Report

## Notable Papers and Addresses Mark Hydro-Electric Conference in Philadelphia—Developments in Equipment and Practices of Water-Power Plants Reported

THE third annual hydro-electric conference under the auspices of the Engineers' Club of Philadelphia was held in that city on March 10. Two technical sessions were followed in the evening by a banquet at which several addresses were given. The feature of the evening meeting was an analysis of the Giant Power Survey report made by Charles Penrose. After indicating the effect of the report on popular imagination, Mr. Penrose subjected it to an economic and technical examination which brought out its engineering and economic fallacies. The main features of the analysis are embodied in the following excerpts from Mr. Penrose's address:

"The proposal which is presented in 'Giant Power' predicates the continued economic existence of the source of base-load power for all of Pennsylvania upon the continued ability of a group of industrial organizations, the mine-mouth companies, to market profitably the immense quantity of by-products and residue which will accumulate daily from the mining of 25,000 tons of coal material for each so-called Giant Power unit. It is not disclosed just how this quantity of industrial commodity is to be disposed of, even in prosperous times, in competition with long-established sources of supply, controlled in part at least by industrial interests in Pennsylvania and elsewhere that have requirements of these commodities which at the present time are secured from plants already established and representing large investment already made.

### Mine-Mouth Plants in Hard Times

"Now look at the other side of the picture. Consider the status of the mine-mouth companies during a period of industrial depression, when there is a remarkably sustained demand for power in Pennsylvania, in the face of a steadily declining demand, and we may assume the application of the inexorable law of supply and demand, in the face of a steadily declining price scale, for the by-product and residue which must be profitably disposed of by the mine-mouth company if its contractual obligations are to be fulfilled in supplying energy to the transmission companies, so that in turn these can fulfill their contractual obligations to the public utility systems, which in their turn are bound by contract with the electric customers throughout our checkerboard map to supply their needs for electrical energy.

"Just where the need appears greatest for complete independence from the unavoidable fluctuations of economic conditions in industry, there it is this report proposes the most intimate and indissoluble dependence for power in Pennsylvania upon industrial conditions.

"Let us consider these mine-mouth generating stations. The report recognizes the necessity for condenser water supply for the efficient operation of these plants, that the coal resources of the state shall be conserved. Engineers know that in order to secure vacua which will give modern economies in steam turbo-generator operation, American practice requires as much as 400 tons of water to each ton of coal burned. You also know the great difficulty found in locating adequate water supply in proximity to the mines in Pennsylvania. The report proposes that the proverbially small summer flow of these rivers in western Pennsylvania can be increased by flood storage to provide the desired water supply; or, in some locations, that recourse be had to cooling towers. Let us consider each of these two proposals separately, keeping in mind that these stations are 500,000-kw. capacity each.

"I will recall to your mind the unprecented droughts of 1923 and 1924 in California, that resulted in unprecedented scarcity in water storage. You will recall too the unprecedented droughts in New England within recent years. Can we consider the stamp of engineering approval given to a proposal that would place the mainspring of the whole of the power supply for Pennsylvania upon a reliance upon flood storage that is dependent upon seasonal variations, and this in a region where water scarcity is a tradition?

"From the standpoint of economy in the use of fuel, artificial cooling imposes two fundamental limitations. The first is the impossibility within practical limits of securing condensing water at a temperature comparable with that of flowing streams. The second limitation is in the fixed losses due to increased pumping head in the operation of the condensing equipment when artificial cooling is employed. These two factors are entirely apart from any consideration of additional capital investment required for such type of installation.

"From another viewpoint: Assuming that artificial cooling were practicable on a scale such as proposed for the Giant Power plants, we must not lose sight of the increased steam consumption, due to the moderate vacua that cannot be divorced from artificial cooling, and the effect upon fuel conservation due to the resultant increased consumption of coal. American practice further indicates that the use of circulating water (from stream flow) will procure vacua averaging at least 1½ in. better than can be secured by the use of cooling towers. It is this 1½ in. of vacuum that determines the difference between modern high operating economy and mediocrity. The coal pile knows the difference!

### Interruptions to Service

"There is little necessity to remind a group of engineers of the economic significance of 'outrages,' or interruptions to service, for an industrial community such as Philadelphia, where because of the character of its industries, the very highest standard of electric power service must be maintained. An interruption works havoc with many industrial processes—textiles, chemicals, electric furnace applications—many more. By the same token, you are familiar with the physical difficulties, upon emergency, introduced by the time element necessary to bring great reserve plants on the line, when the quantities of energy are of the magnitude which Giant Power proposes to supply in the Philadelphia district. Remember, too, that 300 miles across Pennsylvania and over the Alleghanies is not in the same category as southern California with its favorable climatic conditions and comparative absence of lightning disturbances, although California does have those now historic buzzards that have formed the habit of roosting on the transmission towers, much to the disconcertion of the operating staff of the power companies there!

"Great strides in the development of the transmission art can be expected within the next ten years. However, just so long as engineers must deal with physical things, such as steel, copper and porcelain, just so long will we be faced with the difficulties incident to maintaining continuity of service over long transmission lines that impose an additional factor of hazard over that which exists in the best practice in local production and local transmission.

### Reliability Comes First

"We must remember, too, that, in manufacturing, the relatively small part which the cost of power as one of the raw materials plays in the total cost of the manufactured commodity leads the industrial executive to place much greater importance upon reliability and adequacy of service than upon its final bill of cost.

"With the present state of the transmission art, and probably for some years to come, we can have little expectation that the specific problem presented by the close requirements of a metropolitan power market such as in the eastern district of Pennsylvania can overcome the economic barrier which 'outages' present, assuming, as in the report, that main reliance is placed upon transmission over distances of 300 miles across Pennsylvania.

"Again, the immediately preceding statement is not to be construed as opposed to a policy upon which the electric public utility systems in Pennsylvania already are embarked—the policy of interconnection through high-tension transmission, coupling those systems which economically can be interconnected for greater reliability, greater over-all efficiency and greater advantages in the pooling of emergency capacity.

"We can go further and say that the 220,000-volt interconnection trunk lines, which are already designed and on which construction is about to commence in the eastern district of Pennsylvania, follow almost identically the recommendations for such lines that are found in the superpower report of 1921. The construction is being financed privately as an undertaking by the electric utility systems that are

affected. It is safe to say that this program will be proceeded with further just as rapidly as the economics of the situation warrant.

"All this leads us to a consideration of just what is the character of the electric public utility industry in Pennsylvania, under what conditions it is operating, and how fully it is living up to its opportunities and obligations.

"Under the plan under which the electric utility business is conducted in Pennsylvania, the operations, service, rates and the methods of accounting of these companies are under the jurisdiction of that regulatory body which you all know as the Public Service Commission of the Commonwealth of Pennsylvania. In addition, the issuance of securities by the electric utility companies in Pennsylvania is governed by statute. It is important to remember that public utility service in Pennsylvania, also is governed under the law.

### FAIR RETURN MUST BE HAD

"In the determination by the commission of the reasonableness of rates, one of the important considerations is a fair return on a fair value of the property used and useful in performing its public function.

"Stations of larger and larger capacity are being built in response to the only economic pressure that justifies them —the increasing demand for electric service. Not many years ago, in Pennsylvania, stations of 100,000-kw. capacity were numbered among the seven wonders of the state. Now, generating capacities of 600,000 kw. under a single roof are projected. The principle of interconnection — 'superpower,' if you like—is being applied between reasonably adjacent systems, in those cases where again it can be economically justified. It is the old story that every successful business enterprise must show a return on the investment. Hydro-electric resources are being developed and tied in with existing utility systems.

"Recently your speaker had occasion to discuss with a nationally known authority, the director of the U. S. Geological Survey at Washington, the facts as to what the electric public utilities are doing in Pennsylvania. I will read you, in its entirety, a letter received a few days ago from the director, Dr. George Otis Smith:

> The statement which I made Tuesday before the Engineers' Club relative to the public utility power plants of Pennsylvania seemed to me to best express the increasing efficiency of large unit interconnected stations. The better use that we are making each year of our coal takes conservation out of the realm of academic discussion into that of actual results.
>
> On the basis of the figures furnished me by Mr. Horton, who as you know has charge of this particular subject of investigation in the Geological Survey, the average output of the public utility power plants of your state last year was 950 kw.-hr. to the ton of coal, an increase of 100 kw.-hr. over the 1923 record, but with three big plants which together generated about 37 per cent of the total fuel-generated electricity in the public utility power plants of Pennsylvania the corresponding output was 1,550 kw.-hr. to the ton of coal last year, an increase of 150 kw.-hr. over the 1923 record. In other words, these three plants reduced their kilowatt-hour consumption from 1.43 lb. of coal in 1923 to 1.29 lb. in 1924. This saving of 2¼ ounces of coal per kilowatt hour is what I termed "saving coal by the spoonful," but even so small a saving if extended to all of the public utility power plants in your state would have amounted to more than one-third of a million tons.
>
> The other statement which I made yesterday, again on the authority of the figures compiled by Mr. Horton, was the comparison between the fuel consumption and power generation of your Pennsylvania stations last year with five years before. As you know, the Geological Survey records are now available for the years 1919 to 1924. In the fuel-consuming power plants the equivalent coal consumption for 1919 was 5,060,000 tons; in 1924 it was 5,276,000 tons, an increase of a little more than 4 per cent. In this same period, however, the output of these plants increased from 3,070,000,000 kw.-hr. to 5,001,000,000 kw.-hr., or 63 per cent. You may remember that I also commented on the fact that water power is not keeping up with the procession either in your state or in the country as a whole, the water-power plants furnishing something like 11 per cent of the power generated last year in Pennsylvania, as against 16 per cent in 1919, the corresponding figures for the United States being 37½ per cent in 1919 and a little less than 34 per cent last year.

"Nowhere in my remarks to you tonight have I alluded thus far to the accuracy or inaccuracy of the estimates of construction cost that are made a part of the Giant Power report. In terms of its engineering and economic significance and because of a single fact, I feel reference is due to the 'wave of the hand' by which in the report the 'step-down' substations connected directly to the proposed 220,000-volt Giant Power transmission lines have been ignored in the estimates of cost. The single fact which merits this mention is that a very cursory investigation indicates that the cost of equipment for taking energy from the Giant Power transmission lines to the lines of the local distribution utility companies would be of the same order of magnitude as the report's estimated cost of the Giant Power transmission lines themselves."

### OTHER BANQUET SPEAKERS

Another after-dinner speaker, Dr. William F. Durand, president American Society of Mechanical Engineers, gave a notable address on power resources which showed the necessity for conserving oil to postpone the threatened exhaustion of the existing supply in about twenty years. He also dwelt upon the supremacy of coal in the production of power and the necessity to supplement water power with steam plants. Arthur E. Pope of the New England Power Company told of the effect of interconnection on the development of New England. Originating in large measure under the war stimulus, interconnection has permitted utilities to replace small inefficient plants and to tie together water-power and tidewater steam plants to give ample and cheap power. He said that, roughly, two billion kilowatt-hours of hydro-electric power is needed from outside of New England to develop the most economical power supply. The necessity for a study of the principles governing power interchange or sale contracts was also accented.

### TECHNICAL MEETING

The technical proceedings of the conference were opened by an address by C. N. Lauer, president of the Engineers' Club, after which the following papers were presented and discussed:

1. "Hydraulic Machinery," by Dr. A. M. Greene, Jr.
2. "Operation of Combination Steam and Hydro Plants for Best Economy and Proper Governing," by W. M. White.
3. "Operation of Hydro-Electric Units for Maximum Kilowatt-Hours," by F. Nagler.
4. "Interrelation of Operation and Design of Hydraulic Turbine," by F. H. Rogers and L. F. Moody.
5. "Operating Problems and Their Relation to the Design of Hydro-Electric Machinery in the West," by Ely C. Hutchinson.
6. "Operating Practice in Hydro-Electric Developments," by Charles B. Hawley.
7. "Features of Design in Latest Hydro-Electric Generators," by M. C. Olson.
8. "Recent Developments in Hydro-Electric Generators," by F. D. Newbury.

About three hundred engineers attended the meetings, and many took part in the discussions. A reduction in cost was accented as the most desirable thing to aim for in hydro-electric stations and developments, and the opinion was expressed that saturation had about been reached in both water-wheel and generator efficiencies, since 88 per cent of the total water energy from forebay to tailrace is now placed on the busbars of the best hydro stations.

## Washington View of the Giant Power Survey Report

While the consensus of opinion in official quarters in Washington is that Governor Pinchot's scheme of giant power is thoroughly impracticable, there is very general sympathy with some portions of the recently issued report. The report favors public utility service provided by private capital under state regulation. It favors widespread interconnection of transmission lines, large unit generation and high-voltage transmission. It favors enlarged powers of eminent domain, central-station distribution as against isolated-plant distribution, and regulation such as will preserve all rights of security holders to continuity of return. While government ownership and operation are not dealt with directly, the obvious intention and effect are to discourage the public from seeking improvement of utility service by direct state or federal operation.

On the other hand, the report is held to be particularly faulty in its attempts to establish analogies with the railroad situation. Apparently the ability of the states to deal with questions of regulation is doubted in the report, although the questions involved in the importing and exporting of electrical energy across state boundaries are dealt with in a confused and unsatisfactory manner. There is much sympathy in official quarters with the determination of the industry to resist federal regulation along the lines of that exercised by the Interstate Commerce Commission. The administration is definitely opposed to further centralization in Washington. A very generally held opinion is that the states have ample authority to require the electric utility companies to maintain adequate service at reasonable rates and that the states feel entirely competent to protect themselves in this matter and facilitate local regulation. It is believed that the states do not share Governor Pinchot's fears that a gigantic power trust is in the making. Investigations by the Department of Commerce have gone far enough to establish that while there are certain legal difficulties surrounding the interstate power situation, none of the obstacles is insurmountable.

## Handling Storm Wreckage

**Detailed Instances of the Way St. Louis Company Restored Its Overthrown Lines**

AN ECHO of the great Middle West sleet storm of December 18, 1924, which, as was reported in the ELECTRICAL WORLD, caused such widespread damage to transmission systems of central-station companies, especially in Missouri and Illinois, is given by the February *Bulletin* of the Missouri Association of Public Utilities, which recounts how the Union Electric Light & Power Company of St. Louis met the emergency, giving much credit both to the construction crews for their arduous and long-continued efforts to restore service in suburban districts and to the public for its good nature and ready understanding of the impossibility of immediate resumption in every locality.

"The most spectacular damage," says the *Bulletin*, "was along Olive Street Road, where 2½ miles of transmission line lay across the pavement. Eighty-three poles, which had carried the 27,000-volt transmission line from Page Avenue, were down. Every 4,000-volt main feeder in the county was down, for that matter. No such condition ever had existed before. Virtually all communities in St. Louis, St. Charles and Franklin Counties were without electric service—Overland Park, Jennings, Ferguson, Webster Groves, Kirkwood, Pacific, Washington, Union, St. Charles, Glendale, Fenton, Afton.

"A force of 300 men plunged into the work of clearing the wreckage. In the beginning some men worked forty-eight hours at a stretch. For several days sixteen hours' straight duty was not uncommon. For the remainder of the period the men worked from daylight until dark, for it was found that progress was not rapid under flares at night, and it was necessary that the strength of the men be harbored for the long days ahead. Working conditions could not have been worse. Cold succeeded rain, and the temperature hovered for several days between 4 deg. above zero and 4 below.

"The result of the men's steadfastness was quick restoration of the Olive Street Road line. It went out of service at 8 o'clock on the evening of the eighteenth. It was completed in two hours less than three days. The outage on the line was the longest since it was built in 1916. In other sections equivalently good records were made. On one stretch of Gravois Road four gangs erected forty-five new poles and straightened seventeen others in one day. On St. Charles Rock Road thirty-five poles went up in one day. On another section of Olive Street, from Price to Denny Road, sixty-five poles were replaced and reset along the same line with the 66,000-volt transmission line, and not an interruption in service occurred. In Ferguson a crew erected nine poles in half a day. Eighteen poles went up on Clayton Road on Christmas Day. In all these locations the pole-erecting crews were followed by wire-stretching crews who replaced lines as rapidly as possible in the order that they were valuable to the largest number of customers."

## Record Line Construction in Illinois Follows Storm

The cutting over on February 15 of the new high-tension power line between Decatur and Riverton, Ill., built after the midwinter sleet storm wrecked the steel-tower line, was a record in construction for the Hoosier Construction Company, which had the contract. The company began work on January 2 and since that time had set 1,200 poles with cross-arm attachments and strung three strands of wire. M. L. Harry, manager Decatur division, Illinois Power & Light Corporation, is planning careful watch over the pole line during the spring thaws and for the period before new steel towers are completed.

## Plans for April Meeting

**A. I. E. E. Prepares Diversified Technical Program, with Ample Entertainment and Trips**

ST. LOUIS, as previously announced, will be the scene of the spring convention of the American Institute of Electrical Engineers, to be held from April 13 to April 17 inclusive, and everything points to a highly successful meeting which may set a record for the spring gatherings of the Institute. The convention will be held at the Hotel Chase, a commodious hotel situated in exceptionally attractive surroundings fifteen minutes from the city's business center.

Power plants and systems, industrial, marine and mine applications, machine design and communication will constitute the major topics of the technical papers. Five of the most modern power plants will be discussed in one session, and another session will cover the use of frequency changers, reactors, automatic substations and cable crossings. Four machinery papers will cover short-circuit currents, two-speed synchronous motors and self-excited synchronous motors. Under the general topic of communication, papers will be given on loud speakers, railroad communication, echo suppressors and frequency

## Tentative Program of Spring A. I. E. E. Convention

**ST. LOUIS, APRIL 13-17**

MONDAY, APRIL 13

*Afternoon.* — Power Plant Session; under auspices of committee on power generation (Vern E. Alden chairman): "Trenton Channel Station," C. F. Hirshfeld, Detroit Edison Company; informal discussion on the electrical and mechanical features of the following stations: Philo station of the Ohio Power Company, E. H. McFarland, Beech Bottom Power Company; Weymouth station of the Edison Electric Illuminating Company of Boston, I. E. Moultrop; Cahokia station of the Union Electric Light & Power Company, H. W. Eales.

TUESDAY, APRIL 14

*Morning.* — Power Systems Session; under auspices of committee on protective devices (H. R. Woodrow chairman): "Interconnection of Systems with Frequency Changers," H. R. Woodrow, Brooklyn Edison Company; "Eight Years' Experience with Protective Reactors," James Lyman, L. L. Perry and A. M. Rossman, all of Sargent & Lundy; "Mississippi River Crossing of Crystal City Transmission Line," H. W. Eales and E. Ettlinger, both of Union Electric Light & Power Company; "Application of Automatic Control to Substation Apparatus," W. H. Millan, Union Electric Light & Power Company.

*Afternoon.* — Machinery Session; under auspices of committee on electrical machinery (H. M. Hobart chairman): "Initial and Sustained Short Circuits in Synchronous Machines," V. Karapetoff, Cornell University; "Short-Circuit Currents of Synchronous Machines," R. F. Franklin, General Electric Company; "A Two-Speed Salient-Pole Synchronous Motor," R. W. Wieseman, General Electric Company; "Self-Excited Synchronous Motors," J. K. Kostko, Palo Alto, Cal.

WEDNESDAY, APRIL 15

*Morning.* — Communication Session; under auspices of committee on communication (O. B. Blackwell chairman): "A New Hornless Type of Loud Speaker," C. W. Rice and E. W. Kellogg, both of General Electric Company; "Communication in Railroad Operation," I. C. Forshee, Pennsylvania Railroad System; "Echo Suppressors for Long Telephone Circuits," A. B. Clark, American Telephone & Telegraph Company and R. C. Mathes, Bell Telephone Laboratories, Inc.; "Frequency Multiplication," N. Lindenblad, Radio Corporation of America, and W. W. Brown, General Electric Company.

THURSDAY, APRIL 16

*Morning.* — Marine Session; under auspices of committee on applications to marine work (L. C. Brooks chairman): "Historical Review of Electrical Applications on Shipboard," H. L. Hibbard and William Hetherington, Jr., both of Cutler-Hammer Manufacturing Company; "The Electrical Engineer in the Merchant Marine," G. A. Pierce, William Cramp & Sons; "Electrical Ship Propulsion," H. F. Harvey, Newport News Shipbuilding & Dry Dock Company, and W. E. Thau, Westinghouse Electric & Manufacturing Company.

FRIDAY, APRIL 17

*Morning.* — Mining session; under auspices of committee on applications to mining work (F. L. Stone chairman): "Coal-Mine Electrification," W. C. Adams, Allen & Garcia Company; "Application of Motors to Line Locomotives," W. C. Clark, Westinghouse Electric & Manufacturing Company; "Automobile Lighting," J. H. Hunt, General Motors Research Corporation; "A Vibration Recorder for Pathological Analyses," C. I. Hall, General Electric Company.

*Afternoon.*—Industrial session; under auspices of committee on general power application (A. E. Waller chairman): "Load-Building Possibilities of Industrial Heating," C. L. Ipsen, General Electric Company; "A High-Frequency Induction Furnace Plant for the Manufacture of Special Alloys," P. H. Brace, Westinghouse Electric & Manufacturing Company; "Electrically Heated Lead, Solder and Babbitt Pots," J. C. Woodson, Westinghouse Electric & Manufacturing Company; "Synchronous-Motor Drive for Rubber Mills," C. W. Drake, Westinghouse Electric & Manufacturing Company; "Use of Purchased Power in Glass Manufacture," A. L. Harrington, Pittsburgh Plate Glass Company.

multipliers. Under the heading of industrial topics there will be papers on marine applications of electricity, mining applications, industrial heating, induction furnaces, babbitt pots, rubber-mill drive and glass manufacture. Automobile lighting will be covered in another paper.

PLENTIFUL ENTERTAINMENT

Among the social events scheduled for the meeting are an informal reception and dance on Monday evening, April 13; a smoker and also a ladies' theater party Wednesday evening and a banquet and dance Thursday evening. The banquet will be enlivened by music and other entertainment. There will be short talks by two or three prominent speakers, including Past-president F. B. Jewett. Golf, tennis and sightseeing trips, with especial attention to the enjoyment of the visiting ladies, have been arranged for. Inspection trips will include the Cahokia plant of the Union Electric Light & Power Company.

## Railroad Electrification Proposed in Quebec

As the result of a bill just passed in the Quebec Legislature, the way is open for the Abitibi Southern Railway Company to expropriate water power to be used in the proposed electrification of the railroad. The water-power expropriation clause in the bill stipulates that the power developed must be used exclusively for this purpose. The power of expropriation does not apply to developed or partially developed water powers.

Premier Taschereau took occasion recently at a public dinner to suggest to the railroad companies operating in the province the advisability of shifting to electric power.

## Power Exportations from Canada Under 1924-25 Permits

Figures presented in the Canadian House of Commons recently show the quantities of power under permit by the government for export to the United States in the fiscal year 1924-25 to be as follows: Cedars Rapids Manufacturing & Power Company, 100,537 hp.; Ontario Power Company, 60,322 hp.; Electrical Development Company of Niagara Falls, 46,919 hp.; Canadian Niagara Power Company of Niagara Falls, 60,322 hp.; Maine & New Brunswick Power Company, 3,351 hp.; Ontario & Minnesota Power Company, 4,022 hp.; Western Canada Power Company, 13,404 hp.; British Columbia Electric Railway Company, 6,702 hp.

## More Legislative Projects in Indiana

The first radio bill of the session reached the Indiana Legislature recently when Representative Farrell of Hartford City introduced a measure requiring distributors of electrical energy to maintain an inspection department to find leaks and defects in wiring or equipment which set up electromagnetic waves of radio frequency. The penalty for non-compliance with the rigid provisions of the act may amount to $100 a day.

Louis K. Karns, Indianapolis, who conducts a "public utility billing audit and engineering bureau," has announced that he has prepared and will have presented to the Indiana Legislature a Senate joint resolution to be transmitted to the United States Congress asking that Congress "provide by appropriate legislation for the creation of a public utility valuation division of the Interstate Commerce Commission, or any federal body having to do with the industries of the United States, which will set out a report on the unit price of commodities used by public utilities to aid public service commissions and public utility accountants to arrive at a very good arbitrary figure as a basis for valuation."

The board, according to Mr. Karns, would not arbitrarily set figures for any utility or any utility commission. The figures, however, which would be sent out by the board would be regarded as accurate and would be accepted by commissions and federal judges dealing with valuation cases.

# Railway Ordinance Passes Chicago Council

### To Be Submitted to Referendum Vote April 7—Takes Over All City Transit Utilities by Substitution of Railway Certificates for Outstanding Stocks and Bonds

AFTER thirty years of attempts on the part of the traction companies and politicians separately and collectively to solve Chicago's transportation problem, the City Council of Chicago on February 27 passed an ordinance authorizing the city to take over the elevated and surface lines. The price agreed upon by the traction representatives is $248,000,000 in round numbers, to be financed by the substitution of municipal railway certificates for outstanding stocks and bonds. The ordinance provides for the unification and gradual extension of all the lines and the building of subways, all operations to come under the control of a municipal railway board. Citizens of Chicago will vote on the ordinance April 7.

The ordinance is the result of agreements recently reached by Mayor Dever, bankers representing transit bond holders and representatives of the transportation systems. Of the $248,000,000 in railway certificates $162,843,584 represents the purchase price of the Chicago Surface Lines, $85,000,000 that of the Chicago Rapid Transit Company and $247,000 that of the portion of the Chicago & Joliet Electric Railway within the city limits. The program involves the ultimate expenditure for extensions and new construction of about $520,000,000.

The "municipal railway certificates" are not general city bonds, but are secured as to principal and interest by the property and earnings of systems taken over. To make the certificates marketable under this limitation the ordinance provides that a rate of fare must always be maintained which will be sufficient to pay the interest on the certificates and provide a sinking fund which will retire them at the end of forty years. The certificates will bear interest at 5 per cent. To secure the payment of the interest and principal of these certificates the city mortgages all the property which it acquires with municipal railway certificates to a responsible trust company. This mortgage, together with the provision for adequate rate of fare to pay all charges, is the only security given by the city to insure such payment. Failure to pay principal or interest allows foreclosing, but no franchise to operate is granted in the event that this happens.

Although title to the properties will be taken by the city, the control and operation will be vested in a board of nine members. Three are to be selected by the mayor with approval of the City Council, three by holders of certificates, and three by agreement of the Mayor and the certificate holders' committee.

## North Carolina Commission on Power Industry

The electric power industry of North Carolina in 1924 made provision for expending more than $10,000,000 in new investments, according to the report of the Corporation Commission of that state, recently presented. Still further and greater expansions now in progress of development are also noted. "This continues to be one of the state's greatest developments," says the letter of transmittal accompanying the report, which adds that there are now in excess of 2,000 miles of high-power transmission lines within the borders of North Carolina. With all the expansion during the year the commission reports that the light and power companies "are very little more than able to keep pace with the demand."

In submitting its report the commission makes this comment: "The cities and towns of the state have found that with available power for industrial purposes it is possible for them to invite industrial enterprises within their limits that would otherwise be impossible. This fact makes additional investment in these utilities attractive, and there are several propositions now under consideration for extensive additional development. Because of the state's general industrial development being so dependent upon the adequate development of this industry, we have striven to make it as easy for our utilities to obtain money for investment in additional facilities and extensions as it is for utilities in other jurisdictions.

"There are more than 250 cities, towns and villages with electric light service, and a census of 120 of these shows 101,303 customers, of which approximately one-fifth are industrial and four-fifths are residential customers. Therefore, basing the using population upon the United States census average

family of five, the number is 400,000, and it probably exceeds this amount sufficiently to equal one-sixth of the state's population."

## Briefer News

**Two New Institute Sections Formed.**—Announcement is made of the formation of two new sections of the American Institute of Electrical Engineers—the Nebraska Section, formed at Omaha, with P. M. McCullough as chairman, and the Niagara Frontier Section, formed by members in and near Buffalo and Niagara Falls, with J. Allen Johnson as chairman.

**Cleveland Regional A. I. E. E. Meeting Postponed.**—The regional meeting of the A. I. E. E. which was scheduled to be held in Cleveland on May 22 and 23 has been postponed on account of coming too close to the St. Louis Institute convention in April on the one hand and the Saratoga annual convention in June on the other. A new date has not yet been set.

**Oklahoma University Engineering Department to Keep Open House.**—The new engineering building of the University of Oklahoma will be the scene of the annual "open house" of the engineering department of that institution on March 17, when the A. I. E. E. branch will be in charge of the electrical display. On this occasion the entire public is invited to visit the college and become acquainted with its engineering accomplishments.

**Los Angeles Seeks to Take Over Portions of Edison System.**—The Public Service Commission of Los Angeles has applied to the California Railroad Commission to fix compensation to be paid by the city for the distributing system of the Southern California Edison Company in twenty-six additions to the city of Los Angeles not included in the territory covered by the original contract under which the city purchased the lines of the private corporation within the city up to May 16, 1922.

**Danbury, Conn., Decides Against Buying and Operating Local Plant.**—At the second reading of the resolution before the Common Council of the city of Danbury, Conn., favoring the city's purchase and operation of the Danbury & Bethel Gas & Electric Light Company as a municipal plant, the motion was defeated by a vote of seven to one. As recounted in these columns on February 21 (page 425), lower rates have been offered by the utility company, which is a Doherty property.

**Another Plant on Ottawa Authorized.**—Announcement was made by Premier Ferguson on February 19 of the authorization by the government of the development of power at Roche Fondu on the Ottawa River, near Arnprior. The development, with storage, will provide 66,000 hp. for eastern Ontario. It is estimated that the proposed works will cost over $3,000,000. On the Quebec side of the Ottawa River, where it is proposed to construct the power plant, is an island to which the Hydro-Electric Power Commission, through negotiation with the Province of Quebec, hopes to build its dams.

**American Interests Acquire South American Plant.**—Interests associated with the American & Foreign Power Company, Inc., have bought control of the Empresa de Luz i Fuerza Electrica, S. A., serving the city of Guayaquil, Ecuador, with electric power and light, and owning and operating the electric railway there. The Electric Bond & Share Company, New York, is the fiscal agent for the American & Foreign Power Company.

**Secretary Hoover Seeks Plan to Conquer Radio Interference.**—Although an appropriation of $125,000 for use by the Commerce Department in attempting to eliminate radio interference was killed in the final legislative jam in Congress, Secretary Hoover will continue his efforts in this direction and the request will be renewed before the new Congress. "We had hoped that another year of experiment and progress in the art might indicate what could be done," Mr. Hoover said. "It is difficult to determine how the confusion will work out. If any one can work out a scheme which will give the basis for radio control in the interest of the greatest number of radio users, it will be a most valuable contribution to the task of the industry and the government."

### Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, January 3, page 76.]

Illinois State Electric Association—Hotel Sherman, Chicago, March 18-19. R. V. Prather, Illinois Mine Workers' Bldg., Springfield, Ill.

American Institute of Electrical Engineers—St. Louis, April 13-17; Swampscott, Mass. (regional), May 7-9; Saratoga, N. Y., June 23-27. F. L. Hutchinson, 33 West 39th St., New York.

Southwestern Division, N. E. L. A.—Eastman Hotel, Hot Springs, Ark., April 21-24. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Arkansas Utilities Association, Hot Springs, Ark., April 21-24. R. I. Brown, Arkansas Central Power Co., Hot Springs, Ark.

American Electrochemical Society—Niagara Falls, N. Y., April 23-25. C. G. Fink, Columbia University, New York.

Southwestern Public Service Association—Rice Hotel, Houston, Tex., May 5-8. E. N. Willis, 403 Slaughter Bldg., Dallas.

Missouri Association of Public Utilities—Joplin, Mo., May 7-9. F. D. Beardslee, 315 North 12th St., St. Louis.

Electrical Manufacturers' Club—Hot Springs, Va., May 19-22. S. B. Belden, Jeffrey Manufacturing Co., Columbus, Ohio.

Middle West Division, N. E. L. A.—Hotel Fontenelle, Omaha, Neb., May 20-22. (Conjointly with Nebraska Section.) H. M. Davis, Fraternity Building, Lincoln, Neb.

Electric Power Club—Hot Springs, Va., May 25-28. S. N. Clarkson, B. F. Keith Bldg., Cleveland, Ohio.

Electrical Supply Jobbers' Association—Hot Springs, Va., June 2-5. Franklin Overbagh, 411 S. Clinton St., Chicago.

American Association of Engineers—Orlando, Fla., June 2-5. C. E. Drayer, 63 East Adams Street, Chicago.

Iowa Section, N. E. L. A.—Waterloo, Iowa, June 3-4. H. E. Weeks, 623 Union-Davenport Bldg., Davenport.

Associated Manufacturers of Electrical Supplies — The Homestead, Hot Springs, Va., June 8-12. F. Nicholas, 30 East 42d St., New York.

National Electric Light Association—San Francisco, June 15-19. M. H. Aylesworth, 29 West 39th St., New York.

**Virginia Protests Against Diversion of New River.**—Official representatives of the State of Virginia have protested at a hearing held in Bluefield by a Federal Power Commission engineer against the proposed diversion of the waters of the New River into the Fisher River, a tributary of the Yadkin, which is in North Carolina. The Appalachian Power Company, which has a number of plants along the New River, is said to be strenuously opposing the proposal, while the Eastern States Development Company of Wheeling, W. Va., is seeking a preliminary permit for water-power development. Virginia's protest is based largely on the riparian rights of Virginia landowners living along the New River.

**Metermen's Course at Yale.**—Plans are being made for a course for electric metermen at Yale University, New Haven, during the week beginning April 12, 1925. J. Frank Murray, chairman Meter Bureau of the New England Division, N. E. L. A., announces that his committee has approved the proposal and will co-operate with Prof. A. E. Knowlton in the conduct of the course. It is intended primarily for men who have already had at least a few months experience in a meter department or some equivalent training, but if there is demand for instruction of beginners, provision will be made for them as well. Inquiries about the course should be addressed to Mr. Murray, who is superintendent of the meter and lamp department, United Electric Light Company, Springfield, Mass.

**Centralia, Wash., to Get Energy from Manufacturing Company.**—The city of Centralia, Wash., whose municipal electric light department has heretofore purchased energy from the Sherman County Light & Power Company, has signed a contract with the Western Cross-Arm & Manufacturing Company whereby this firm will furnish electricity to the city for a period of ten years. Rates specified are 2½ cents per kilowatt-hour for energy to be resold for lighting purposes, 2 cents for energy for city lights and 1 cent for electricity for power, heating and cooking purposes. The company operates a mill in Centralia and agrees to erect a power plant at a cost of $100,000 and have it ready for operation by October 1. Centralia is reached also by the lines of the Puget Sound Power & Light Company of Seattle.

**Indiana Electric Corporation Leases Coal Land.**—A lease of 1,000 acres of coal land near Terre Haute, Ind., to the Walter Bledsoe Company by the Indiana Electric Corporation, which owns

the new Wabash River plant and the coal land surrounding it, was recorded recently. The mining company is to pay 5 cents a ton to the electric company and is to mine the No. 5 vein. The terms of the lease provide that the corporation can buy the shafts of the Bledsoe company for the original cost price less 10 cents a ton for every ton removed or hoisted by the machinery at any time by giving a ninety-day notice. The lease will begin from the day the mine is capable of hoisting 200 tons a day and will run for a period of ten years. The lease, however, is not to be in effect after March 1, 1937. Coal is to be sold to the electric company at a price agreed on March 1, 1924.

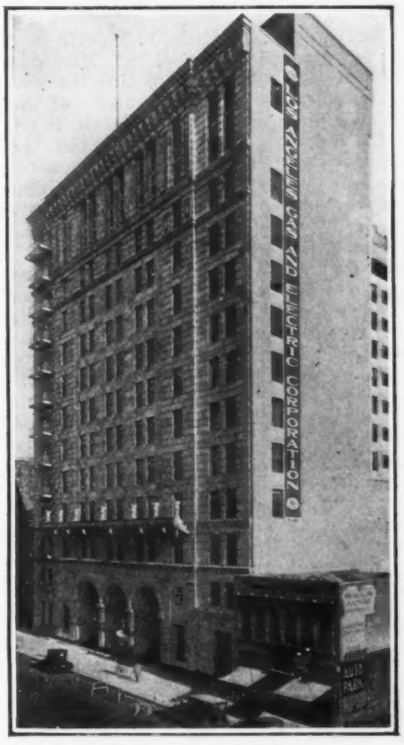
**Pit No. 3 Keeps Up to Schedule.**—Work on the Pacific Gas & Electric Company's Pit River project No. 3 is progressing according to schedule. The dam across the river is completed except for the roadway that is to be built on it for the use of the public. The walls of the power house are up, but the roof has not yet been put on. The work of lining the four-mile tunnel is progressing well. It is expected that Pit No. 3 will be brought in early in July, as previously predicted. The plant will generate more than 100,000 hp., and the Pacific Gas & Electric Company is already prepared to distribute the power in the northern and the central parts of the state, probably shutting down some of its steam plants.

**Winnipeg Hydro in Negotiation with Electric Company for Division of Field.**—Conferences have been taking place between representatives of the Winnipeg (Manitoba) Electric Company and the city of Winnipeg Hydro-Electric System with a view to effecting arrangements under which each utility will have a separate field for its commercial operations. At the present time the two utilities are in active competition, and as a result the expenditures of both are relatively higher than is the established practice in other centers. It has been suggested that Winnipeg should purchase the company's electrical distribution system within the city limits and operate it as part of its own city light service. The company would then continue to operate the street-railway and gas supply services. Its subsidiary, the Manitoba Power Company, would control the distribution of power in the suburbs of Winnipeg and throughout the remainder of Manitoba without interference from the city system and would find a growing market for excess power from the company's development at Great Falls.

**International Board to Pass on New Brunswick Power Project.**—The International Joint Commission has fixed March 25 as the date of the first hearing by that body in connection with the application of the New Brunswick Hydro-Electric Commission for approval of the province's Grand Falls hydro-electric project. This sitting will take place at Van Buren, Me., and, if it is subsequently considered necessary, a further hearing will be held at St. Leonards, N. B. New Brunswick's electrical problems came before the Quebec Legislative Assembly on February 26, when the commission's bill to incorporate S. P. J. Veniot, Premier of New Brunswick, Ernest A. Smith, president of the commission, and J. E. Michaud, a member of the commission, into a company to carry out the Quebec end of the Grand Falls project was up for consideration. It is necessary that storage reservoirs be created in some of the lakes and rivers tributary to the drainage basin on the St. John River. These reservoirs in Quebec are to be constructed in Kamouraska, Temiscouata and Rimouski Counties, under the ordinary provisions as to expropriations applying to private utility companies.

## Los Angeles Gas & Electric Has New Office Building

OWING to the rapid growth of the Los Angeles Gas & Electric Corporation, which supplies electricity in Los Angeles in competition with the municipal system, a new office building was erected at 810 South Flower Street during the past year and was occupied by the company on January 19 of this year. The building is twelve stories in height and the façade is of the type of architecture known as "early Italian."




NEW HOME OF LOS ANGELES GAS & ELECTRIC CORPORATION

The building is modern in every respect with a spacious lobby. The twelfth floor is devoted to employees' welfare exclusively. A cafeteria, lounge and reading rooms, committee rooms and an assembly hall for meetings, dances and entertainments have been provided. There are an automatic interdepartment telephone system a pneumatic carrier-tube system, an automatic elevator for use between departments, an electric clock system, a refrigerating system, basement parking space for company machines, a floodlighting system which illuminates the front of the building with any desired combination of colors, and a vacuum-cleaner system throughout.

**Otter Tail Company to Acquire Another North Dakota Utility.**—The Midwest Power Company, Devil's Lake, N. D., will probably be acquired by the Otter Tail Power Company of Fergus Falls, Minn. Negotiations are said to be nearing completion. The Otter Tail Power Company owns the Jamestown (N. D.) Electric Company, and the acquisition of the second property will bring the Wright utility holdings in North Dakota to a value of more than $5,000,000, second in the state to the holdings of the Northern States Power Company.

**Electrical Drive for Harbor Dredges.**—Electrical apparatus to equip the newest dredge of the port of Portland, Ore., which is the largest electrically driven dredge so far constructed, has been recently shipped from the main works of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa. It is expected that this electrically driven dredge will be ready for operation immediately following the annual spring freshet. The decision of the port of Portland to use electric drive on the new dredge is considered extremely important as probably assuring the universal adoption of this class of equipment for river and harbor excavations of sand and gravel. The contract for electrical apparatus calls for four Diesel-engine-driven, direct-current generators having approximately a total capacity of 2,400 kw., one 2,700-hp. motor and twenty-five smaller motors ranging from 5 hp. to 250 hp. each, with complete magnetic control.

**Irrigation Engineers Report Thirty Power Sites on Columbia River, Aggregating 145,000 Hp.**—Along the distribution canals planned by a special board of engineers which has been investigating the irrigation possibilities of the Columbia River basin for the Department of the Interior there are numerous drops and chutes where power may be developed, according to the report just made. The amount of such power for the several projects varies approximately as their acreage. On a maximum-gravity plan thirty such power sites were selected as practicable and the cost of their development was determined. The combined installed capacity of these thirty plants amounts to 145,000 hp. and the average cost to $58 per horsepower. Other power possibilities are cited, the engineers recommending that wherever developed the net returns from power sales should be applied to the retirement of the capital cost of the proposed project. Five basic plans of river development, of which maximum gravity is one, are outlined by the board, and one of these plans may be recommended to Congress by the Secretary of the Interior, although the report is regarded as lacking in the matter of detailed cost data.

# Men of the Industry

## K. B. Thornton Promoted

Kenneth B. Thornton, formerly general manager of the Canadian Light & Power Company and the Quebec & New England Hydro-Electric Corporation and consulting engineer for the Montreal Tramways Company, has been appointed assistant general manager of the Montreal Tramways, Montreal, Que. In performing the duties of this office, recently created by the company, Mr. Thornton will act as assistant to Lieut.-Col. J. E. Hutcheson, vice-president and general manager. For many years he has been prominently identified with public utilities in Montreal as an executive of the electrical companies and as an officer in electrical associations. A biographical sketch and portrait of Mr. Thornton were published in the ELECTRICAL WORLD Nov. 4, 1922.

## Four United Light & Power Officials Receive Promotion

Four officials of the United Light & Power Company have received important promotions as a result of the recent rapid growth of this Middle Western utility. The four officers mentioned in the promotions recently announced by the vice-president and general manager of the company, B. J. Denman, are R. B. McDonald, C. N. Chubb, H. E. Weeks and H. E. Littig.

R. B. McDonald, who has been general manager of the People's Power Company, Moline, Ill., becomes president of the Davenport, Rock Island and Moline group of United Light subsidiary companies, a position heretofore held by Mr. Denman. He also becomes first vice-president of the Tri-City Railway & Light Company. In 1899 Mr. McDonald was made a clerk in the storeroom of the public utility company at Lincoln, Neb., now a unit in the United Light & Power Company. He worked up to the position of electrician, and in 1906, when Frank T. Hulswit, builder and president of the future United Light chain, was looking for a capable man as superintendent of the Fort Dodge (Iowa) power house, he installed Mr. McDonald in that position. Subsequently the latter was made general manager of the plant, and later he was sent by Mr. Hulswit to the Tri-Cities in 1917 to take charge of the power plant at Moline, Ill., becoming general manager of the People's Power Company there.

C. N. Chubb, who has been general manager of the People's Light Company, the gas and electric company of Davenport, Iowa, will be divisional chief of the Iowa and Nebraska properties of the United Light outside of the Tri-Cities, becoming a vice-president of the corporation. Graduated from the Massachusetts Institute of Technology as a civil engineer, Mr. Chubb entered the employ of the Pennsylvania Railroad and from there went to the United Gas Improvement Company at Harrisburg, Pa. By this company he was made superintendent of the gas plant

R. B. MCDONALD

at Kansas City and promoted first to be general manager of the United Gas property at Sioux Falls, S. D., and then to be general manager at Michigan City, Ind. From there in turn he was advanced to be general manager of the United Gas property at South Bend, Ind. In 1917 Mr. Chubb joined the United Light and was made general manager of the People's Light Company at Davenport. He is a past-president of the Iowa Section of the National Electric Light Association.

H. E. Littig, who is promoted to the position of general manager of the People's Light Company of Davenport, has risen from the ranks, beginning with the Davenport utility company thirty-one years ago and advancing by successive steps to his present position. In 1902 he was made a bookkeeper for the Tri-City Railway Company, one year later becoming chief clerk, in 1907 chief clerk of all the Tri-City companies of the utility chain, in 1915 assistant treasurer of all the Tri-City subsidiaries of the United Light, in 1917 assistant secretary of all these companies and secretary of all these companies in 1918. Mr. Littig will continue to perform these duties for the present.

H. E. Weeks, treasurer of the Tri-City group of utilities and general manager of the securities division of the United Light in charge of sale of customer ownership and employee stock issues, becomes a vice-president of the United Light, his authority in this department extending to the Nebraska division. Made secretary of the public utility companies of Alton, Ill., on entering this field following legislative work in Illinois, Mr. Weeks served in that capacity until 1906, when he was induced by Mr. Hulswit to join the newly organized United Light company. He became secretary and treasurer of the Tri-City utility group and vice-president of the Tri-City Railway & Light Company. Mr. Weeks has been president of the Iowa Railway Association and secretary of the Iowa Section of the National Electric Light Association.

C. N. CHUBB

## Alabama Power Announces Changes in Organization

A. S. Coleman, formerly district manager of the Alabama Power Company at Montgomery, has been appointed manager of the southern division, to succeed L. P. Sweatt, Jr., who resigned to become general manager of the Mississippi Power Company. Before going to Montgomery Mr. Coleman was affiliated with the company's Gadsden office. C. B. McManus, formerly manager of the western division, has been made manager of the northern division to succeed Wells M. Stanley, who resigned to join the Gulf Electric Company as general manager. R. W. Williamson of the commercial department has been promoted to the position of manager of the western division. Mr. Williamson's connection with the organization covers a period of twelve years and followed service of three years as city electrician at Shreveport, La. J. O. Henkel, Jr., district manager at Gadsden, has been transferred to Montgomery in the same capacity and Henry Maulshagen, superintendent of the Gadsden steam plant, succeeds him as manager. J. T. Jackson, who formerly was district manager at Anniston, has become district manager at Sheffield and will be succeeded by J. P. Hagerty, formerly division auditor at Anniston. J. S. Street, district superintendent at Tuscaloosa, has assumed the duties of district superintendent at Sheffield.

## Hydro-Electric Engineers Join Stone & Webster Organization

Murray H. Mellish, William Noyes, Edward A. Rudolph and John H. Winter have joined the hydraulic section of the engineering division of Stone & Webster, Inc., Boston. Mr. Mellish was formerly with the J. G. White Engineering Corporation, New York, and later with Weston & Sampson, consulting engineers, Boston. Mr. Noyes was previously engaged in making water-power investigations and reports for Howard M. Turner, consulting engineer, Boston; Mr. Rudolph was formerly assistant engineer of the hydro-electric department of the West Penn Power Company, and Mr. Winter was on the staff of the Alabama Power Company.

**Walter H. Sammis**, for the past year a member of the power engineering department of Charles H. Tenney & Company, Boston, has been appointed assistant to the vice-president of the Con-

sumers Power Company, Jackson, Mich., where he will have charge of all commercial light, heat and power sales of the entire system. Before joining the Tenney organization Mr. Sammis was engaged in power sales engineering with Consumers Power Company.

**E. D. Arntzen,** formerly associated with the West Penn Power Company, is now connected with the Commonwealth Edison Company, Chicago.

**George Wright,** manager of the Winnipeg office of the Canadian General Electric Company, Ltd., has been transferred to the company's Vancouver office.

**C. H. Courser,** formerly connected, with the Southern Utilities Company in Florida, has been appointed assistant general manager with the Kentucky-Tennessee Light & Power Company, Bowling Green, Ky.

**M. H. Hendee** was recently elected treasurer of the Carolina Light & Power Company, Aiken, S. C., which has been acquired by the J. G. White Management Corporation of New York.

**H. S. Foley,** for the past three years chief engineer and associate manager of the Cia Hidroelectrica é Irrigadora del Chapala, Guadalajara, Mexico, has returned to the United States and is now with the Electric Bond & Share Company, New York.

**Ebert W. Henderson,** who has been with the Canadian Crocker-Wheeler Company, Ontario, since 1908, has assumed new duties in Cleveland, Ohio, with the Reliance Electric & Engineering Company.

**Karl C. Mason,** who has been affiliated with the Nova Scotia Tramways & Power Company, Ltd., Halifax, for the past year and a half as superintendent of the light and power department. is now associated with the Edison Electric Illuminating Company of Brockton.

**Charles A. Williams,** formerly on the engineering staff of the Philadelphia Electric Company and for the past year with the Harvard Graduate School of Business Administration, has joined the power engineering department of Charles H. Tenney & Company, Boston, Mass.

**Charles F. Terrell** has recently been made general superintendent of light and power of the El Paso (Tex.) Electric Railway Company, succeeding J. F. McLaughlin, recently transferred to Baton Rouge. Mr. Terrell has been with the Stone & Webster organization for the past twenty years and at Bellingham for the past two years.

**Howard Ellis** of Indianapolis, Ind., has been appointed secretary of the Public Service Commission of Indiana, to succeed Lawrence C. Loughry, resigned, effective April 1. Mr. Ellis is a graduate of DePauw University, Greencastle, Ind.

**J. H. Hedrick,** formerly identified with the Sapulpa office of the Oklahoma Gas & Electric Company, has been appointed chief engineer of the company's properties at Elk City.

**Albert Sidler,** electrical and mechanical engineer, has established offices in Manila, P. I., to engage in consulting engineering. Mr. Sidler brings to his work more than twenty-one years' intimate knowledge of the local electrical and mechanical engineering fields and successful managerial and executive experience gained during his residence in the Philippines by his connection with Germann & Company, the Philippine Engineering Company and other enterprises.

**M. W. Birkett,** vice-president and general manager of the Washington Water Power Company, Spokane, has been elected a member of the board of trustees of the company, succeeding J. P. M. Richards, deceased.

## J. F. McLaughlin in Baton Rouge

J. F. McLaughlin, who was made manager of the Baton Rouge (La.) properties of the Stone & Webster Company, as announced recently in the ELECTRICAL WORLD, had been head of the light and power department of the El Paso Electric Railway Company for three years. He went to Texas after serving in the rate investigation department of the Stone & Webster Company in Boston. Mr. McLaughlin has

J. F. MCLAUGHLIN

held various positions in the Stone & Webster organization, having been identified with the Blackstone Valley Gas & Electric Company, Pawtucket and Woonsocket, R. I., and the Eastern Texas Electric Company.

**Irving E. Moultrop,** assistant superintendent of the construction bureau, Edison Electric Illuminating Company of Boston, has been elected president of the Engineers' Club of Boston.

**Clarence M. Lewis** of Jackson, Mich., has been elected secretary of the Illinois Power Company, Springfield, Ill., to succeed J. H. Brunnemeyer, who recently resigned because of ill health.

**G. L. Corey,** formerly district manager at Toppenish (Wash.) for the Pacific Power & Light Company, has been transferred to The Dalles, Ore., in the same capacity.

**Ralph H. Williams,** assistant to the director of the personnel department, Stone & Webster, Inc., Boston, has been transferred to the New York office of the organization, reporting to Charles A. Stone.

**C. M. Gassaway,** formerly manager of the commercial department of the East Penn Electric Company, Pottsville, Pa., has been appointed new-business manager of the Portsmouth (N.H.) Power Company.

**Harold C. Lang,** electrical engineer with the West Penn Power Company at Vandergrift, Pa., has been placed in charge of the properties of the Monongahela-West Penn Public Service Company at Grafton, W. Va.

**T. E. Redman** has been appointed general superintendent of the Southern Cities Power Company at Columbia, Tenn., to succeed E. H. Gilliam, who has been transferred to the company's engineering department at Chattanooga.

**B. D. Wilson,** formerly connected with the Middlesborough office of the Kentucky Utilities Company, is now in the company's Harlan branch in the capacity of manager. In an article published in the February 14 issue of the ELECTRICAL WORLD Mr. Wilson's initials were given as E. B. in error.

**C. L. Harold** has been appointed general sales agent of the Brooklyn Edison Company to succeed T. I. Jones, who recently affiliated himself with the W. H. English interests. Mr. Harold, who has had a wide experience in sales, efficiency management and organization work, goes to the Brooklyn Edison Company from Toledo, Ohio.

**W. D. Riggs,** formerly chief electrician of the Oklahoma Gas & Electric Company, has been appointed manager of the company's properties at Elk City. One of the best known electric utility operating men in the state of Oklahoma, Mr. Riggs has been connected with the Oklahoma Gas & Electric organization since 1915.

**A. C. Riggs,** formerly line construction superintendent of the Puget Sound Power & Light Company in Seattle, has been promoted to the position of superintendent of light and power of the company's northern district at Bellingham. Mr. Riggs has been associated with electrical interests in the Northwest since 1906, when he became an employee of the Seattle-Tacoma Power Company.

**H. E. Leigh** has been appointed manager of the Westinghouse department of the Mine & Smelter Supply Company in Denver to succeed Thomas Yonley, who resigned to become associated with the Westinghouse company in Indianapolis. Mr. Leigh has been with the Mine & Smelter organization for two years and previously had served as an engineer on a number of the Doherty properties in Kansas.

**Harold J. Payne,** formerly of the editorial staff of *Chemical and Metallurgical Engineering,* a McGraw-Hill publication, has joined the staff of the Society for Electrical Development. Since his graduation from the Massachusetts Institute of Technology Mr. Payne has been in close touch with process, equipment and material-handling problems of industry. His special work with the society will be promoting the use of electric trucks both for delivery work and in the industrial field.

**Edward W. Kells,** secretary of the Brooklyn Edison Company, was elected to membership on the board of directors at the recent annual meeting of stockholders, to succeed Harry Bronner, resigned.

# Recent Court Decisions

**Death of Plant Superintendent Trying to Make Repairs After Storm Compensable.**—The Supreme Court of New Jersey has found, in Wettstein vs. Whitall-Tatum Company, that compensation must be paid under the workmen's compensation act of the state for the death of a plant superintendent who entered a transformer inclosure to try to make repairs necessitated by the fact that an electrical storm had caused a failure of the wires supplying the plant with energy and who while so engaged was killed by contact with an electric wire. The chief engineer of the company, who was the victim's superior, testified that he had told the latter to stay out of the transformer inclosure because "it wasn't safe." The court, however, held that the facts justified the superintendent's disregard of this prohibition. The deceased lived near the plant, and the defendant company maintained that when the accident took place, at 7 p.m., he was merely trying to restore the lighting in his own house, but the court assumed that he had his duties as plant superintendent in mind. (127 At. 325.)*

**Permission to Buy or Flood Land Must Precede Building of Dam.**—The Ford Motor Car Company of Detroit lost its case before a jury in the United States District Court in Milwaukee in a damage suit for $100,000 brought against it by the Neely family of Crystal Falls and Negaunee, Mich., who charged the unlawful flooding of 27 acres of their lands on the Wisconsin side of the Iron River in connection with the building of the dam and power plant of the Ford Hydro-Electric Company of Wisconsin now in operation on the Iron River near Iron Mountain, Mich. The upper Michigan land owners were awarded a judgment of $41,000. It is doubtful whether the case will be appealed. The trial was mainly in the form of an appeal from an alleged unreasonable condemnation award and settles in the negative the question whether or not a company has the right to build a dam without first obtaining permission to flood the land or purchase it.

**Extent of Liability of Electric Companies for Accident to Employee of Independent Contractor Working Near Lines.**—Lawley vs. Central of Georgia Railway Company and Georgia-Alabama Power Company and Jones vs. same were damage suits based on the death of one workman and the injury of another while helping to construct a bridge over the tracks of the first-named defendant. Three high-tension wires of the other defendant 30 ft. above the railroad's right-of-way were maintained by the power company under an agreement to hold the railroad company free from responsibility for any damage they might cause. On account of the work on the bridge these wires were about to be raised 10 ft., but before this was done the accident happened, owing, it was alleged, to electricity "jumping" from the wires to steel tape which the men were holding a short distance underneath, stated variously as "approximately 2 ft." and "about 1 ft. or 14 in." It was claimed that the workmen were invitees of both the railroad and the power company and that therefore damages could lie against these companies, and the lower court rendered judgment for the plaintiffs. This judgment has been reversed by the Georgia Court of Appeals, which finds that an independent contractor is chargeable with knowledge of ordinary hazards pertaining to premises surrendered by owner, who must retain control to be liable for latent hazards; that the petition showed possession and control of premises by the independent contractors; that the petition did not allege unsafe construction of the high-tension wires, and that there was no privity of contract between the person killed and the power company agreeing to raise the wires. (126 S. E. 273.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

**Why Rates Cannot Be Raised to Recoup Company for Losses Due to Unjust Rates in the Past.**—The United States Court for the North District of Georgia, in a review of gas rates prescribed for the Georgia Railway & Power Company by the Railroad Commission of Georgia, in which it quoted decisions of the United States Supreme Court governing valuation, said in regard to a contention that a company unfairly mulcted by inadequate rates in the past should be allowed new rates high enough to make up the deficit thus forced upon it: "A utility is perhaps entitled, as a matter of right and justice, to more consideration on account of losses sustained under commission rates than for losses sustained through its own failure 'to secure' or 'omission to exact proper prices for its output,' but I doubt if the difference in the character of the losses demands on principle, or even admits, a different rule of law from that laid down in the Galveston case. The results in the two cases are the same. In both cases the utility loses and the users of gas gain. It may be, as counsel for complainants suggest, that justice to the company requires that if the 'public' at one time obtains gas through no fault of the company at less than a reasonable rate, the 'public' at another time during a reasonable period should make good the loss. But this, it seems to me, is an argument which should be addressed to the commission and not to the courts. The public cannot sue or be sued. The public, in fact, did not use the gas of complainants during 1917 to 1920 inclusive. Thirty thousand individuals, more or less, used the gas during these four years, and over thirty-seven thousand individuals are using complainants' gas at this time. At least seven thousand of these had no part in the alleged taking of plaintiff's property without due process of law during 1917 to 1920 inclusive. Upon that correct principle of law can the courts now enjoin a rate fixed under legislative authority and compensatory at this time, when the effect of such injunction would be to require these seven thousand or more users of gas to pay complainants, in the form of increased rates, for gas which was used not by them but by others several years ago?"

# Commission Rulings

**Conditions Which Justify Combined Meter Readings.**—An identity in the person of the customer, unity in the physical locations and similarity in the uses operate to justify the consolidation of meter readings and the rendition of a bill on the consolidated statement, in the opinion of the Montana Railroad and Public Service Commission. This decision applied to meter readings for water supplied to the Florence Laundry Company by the Missoula Light & Water Company in two adjacent buildings for an identical use. The commission said: "Different meters are provided for only when the service is distinct as respects the matter of use or when it is furnished to different persons or corporations, or when it is furnished to the same person or corporation for different purposes. . . . There is no distinction between the two services, or between the purposes of the two meters, save the accidental circumstances of installation some years apart and at a short distance apart. Clearly, the meter readings should have been combined and but one bill rendered for the combined consumption."

**Advantages of Consolidating Competing Companies.**—In granting permission to the Continental Gas & Electric Corporation to acquire stock in the Lincoln Traction Company with the object of ultimate amalgamation, the Nebraska State Railway Commission dwelt on the advantages inherent in the consolidation of competing electric utilitis. These it enumerated as follows: (a) Consolidation of generating plant in due course of time and reduced out-of-pocket cost of production of electricity; (b) gradual elimination of duplicate distribution property at present existing and thereby improvement in appearance of the streets and alleys of the city; (c) gradual elimination of duplicate maintenance costs of present equipment and elimination of certain duplicate labor costs of production; (d) prevention of unnecessary future duplication of extensions into common territory; (e) potential reduction of overhead costs, and (f) potential reduction in charges to the public. Against these it set the loss to the stockholder resulting from the charging out from the value of the plant of the duplicated property. "It might be urged," the commission said, "that elimination of competition will result in less keen efforts on the part of the utility, to the disadvantage of the consuming public. This is a possibility if regulation is inadequate. . . . No justification appears to exist for hesitancy in approving the consolidation on such possibilities of disadvantage weighed against the designated and known advantages."

# Manufacturing and Markets

## Selling the Idea First

**Manufacturer Capitalizes Reported Experience of Users in Selling the Idea of Using Electric Heat**

IN THE development of any new field of application the co-operation of all manufacturers is important in carrying on a campaign to sell the idea behind the new development. Prospects must believe in the idea before they can be expected to believe in the results to be secured from any specific apparatus. The American Resistor Company of Milwaukee, manufacturer of non-metallic heating elements, has been able to use reprints of an article giving the experience of users of electric heat and has distributed this article to prospects in an effort to sell the general idea.

An interesting sidelight on this situation is the fact that the article referred to carried no mention of this company's product, while, on the other hand, it did mention the name of another manufacturer. The object of sending out the reprint was to call the attention of the company's prospects to the advantages of electric heat for treating steel and it was considered that the article, on account of containing specific data on actual operating conditions and costs, would stimulate interest in the general subject of electric heat treating. Representatives of the American Resistor Company stated that while the circulation of this article might be giving some good publicity to another manufacturer, they felt that co-operation along this line would go a long way toward promoting the demand for electric heat. They believe that any information which might be gathered on the use of electric heat, if passed on, would advance the cause. There should be no desire on the part of any one to withhold any information; the field is large enough for all.

## Setting a Pace for Electrical Contractors

THE head of a large association of electrical contractors reports that many general building contractors who construct small residences for sale are stealing the thunder of the electrical contractor in specifying and installing more complete electric wiring installations than are recommended by the electrical contractors themselves. Many of these building contractors are installing three and four appliance outlets per room, and recently one of them reported that he was planning the installation of permanent electric heaters in bathrooms. This type of heater had been brought to the attention of the contractor and he immediately saw the added selling point which residences would have if he could tell prospects that the bathrooms were equipped with permanent electric heaters. The generous use of outlets specified by these building contractors is evidenced by the demand for six-hole knockout ceiling plates. A representative of one of the electrical contractors' associations suggested that many of the electrical contractors were more interested in meeting a competitor's price than the popular demand for appliance outlets and modern wiring installations.

## Production of Aluminum in 1924

THE new aluminum produced in the United States in 1924 had a value of $37,607,000, which is an increase of almost one-third over the value of the output in 1923, according to a statement issued by the Department of the Interior, prepared by James M. Hill of the Geological Survey. Aluminum of 99 per cent grade was quoted at 27 cents a pound during the first week in January, but the price rose to 28 cents and remained stationary until the middle of March. During April, May, June and July the price was 28-29 cents, but in August it was 28 cents, where it remained until the end of the year. The price of metal of 98 per cent grade was steadily 1 cent under that of the purer metal. The domestic demand for aluminum, much of it for automobile parts, was somewhat less in 1924 than in 1923, as the production of automobiles was smaller, and some manufacturers are now using pressed steel instead of the higher priced aluminum.

## Service Versus Price as a Buying Basis

**Number of Purchasers Who Appreciate Service Above Price Increasing—What the Value of Prompt Delivery Meant to One Purchaser**

BY AN EXECUTIVE

IN ANY line of business which may be selected there are at least two classes of purchasers. One consists of persons who apparently place price above all other considerations and who will haggle and delay until they get what they consider is the lowest price for the product. The other class places service first with all that it involves, such as reputation for square dealing, an attempt to meet every reasonable demand, quality products, fulfilled promises, prompt delivery and equitable adjustments where any are warranted. It is to the latter class which this company prefers to cater.

From my experience of twenty-seven years in the pole business I believe that more and more people are beginning to appreciate service and are willing to pay more for it than they are where products are sold only on a price basis. The growing appreciation of such service is evident in more than the pole business, and producers and distributors in other lines who are progressive recognize the fact and are rendering the service. There will always be the class of purchaser who puts price above everything else because some people will not look beyond the immediate investment and consider how this narrow viewpoint may lead to greater expense in the end. When it is considered that the persons or companies who have been purchasing on the service basis for years include those who have given the most thought to the ultimate economy, it seems apparent that service at a nominal price deserves the consideration of even more purchasers, producers and distributors than it does at present.

Taking the pole business, some specific examples of service rendered can be cited to show how the purchaser benefited, how the producer was able to give the service and how he benefited by it.

### PROMPT DELIVERY SAVED A CONTRACT

A utility company in the Middle West had a contract amounting to several thousand dollars to supply power to a certain community which involved building a line requiring several hundred poles. If the service could not be supplied in twenty-one days, the contract would become void. Attempts were made to obtain poles at a low price by purchasing from brokers, but because of uncertainties of transportation deliveries could not be promised within the desired time. The utility asked the writer to ship them immediately. Owing to the large quantities of various grades of poles kept on hand in storage yards at distribution centers and the successful attempt to have pole cars attached to a fast merchandise train, it was possible to deliver the poles in a few days so that one circuit was completed and the contract to supply power fulfilled. If delivery could not have been made in the time consumed, a valuable contract would have been lost.

It is not this company's policy to ship promptly only when requested. Because of making it a practice to have cars loaded or at least ready for loading at all times, it is the policy to give each purchaser the car number immediately upon order and to ship the poles out promptly. If deliveries are delayed, even though the poles are not

needed immediately, the purchaser will have the impression left in his mind when he considers his next purchase that it took so many days to fill his order and he had better try some one else when he needs a rush order.

### POLE TREATMENT REQUIRES TIME

Many times purchasers of poles do not consider that treating of poles requires time, and they probably should not be expected to recognize this fact any more than a purchaser of clothing should be expected to know that the wool in a suit has to be obtained from Australia, the cotton from Egypt, etc. As a result they frequently ask for an immediate shipment of treated poles. In one case where this happened the purchaser was asked whether delivery or treatment was most essential. He said both. Since it was impossible to comply with both requirements the poles were treated and sent out as soon as possible. Although poles can be treated and kept in storage for such demands, their appearance changes on standing and may leave the impression that they are not properly treated, so they have to be re-treated for a short period. The best grades of creosote oil are light-colored, and because the color does not show so plainly as in the lower grades, purchasers sometimes think poles are not treated.

Demands are often made by the purchaser for certain sizes and grades of poles not realizing that they are a nature-grown product and not a manufactured product that can be controlled. Some pole distributors try to meet this demand by switching stocks as occasion demands. Sometimes there are not enough poles of the sizes required, and then the progressive distributor who is trying to serve will go to the prospective purchaser, study his needs and show, if possible, how he can get along with poles of other sizes. While this is a detestable practice in connection with a manufactured product, it is absolutely essential with nature-grown products.

Once a producing or distributing company establishes a reputation for honest dealing and a single price regardless of haggling, it will find that the old methods of getting business are unnecessary and even objectionable.

# World Demand for Copper Large

## Consumption at a High Figure but Production Is More than Sufficient to Meet the Demand—Electrical Manufacturers Largest Consumers—Firm 15-Cent Level Expected

DESPITE the fact that the world demand for copper is practically as large as it was at any time during the World War, and far larger than in previous peace times; that European demand is increasing markedly; that stocks are no more than normal, and that many large electrical projects are being considered that will require immense tonnages of the red metal, copper prices continue below 15 cents a pound, with little prospect that the current year will witness any sustained advance much above this level. Present prices of copper are about what they were ten to fifteen years ago, although the prewar dollar is worth only about 65 cents in other commodities.

In the closing months of 1924 copper prices advanced gradually and some well-informed followers of the market expected to see a 16-cent level reached in March, but since early January buying has been on a smaller scale and prices, which had been as high as 15½ cents, sagged off to 14½ cents, though at that level there was but little pressure on the market, and there is evidence that when a good buying movement sets in, as is likely during this month, or early April, a firm 15-cent level will be re-established.

Copper producers have no fault to find with consumption. For over a year now it has continued on an unprecedented scale in the United States, and recently, with the re-establishment of financial stability in Europe, consumption there has increased greatly. As money becomes available in Europe a large number of public utility developments will be carried out, plans for which have lain dormant since 1914. A recent tabulation made by the American Bureau of Metal Statistics will give a fairly accurate idea of the trend of domestic copper consumption by quarters during the last two years:

| | Consumption in Millions of Pounds | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1923 | | | | 1924 | | | |
| | I | II | III | IV | I | II | III | IV |
| | By Quarters | | | | | | | |
| Electrical manufacturers | 75.0 | 86.0 | 90.0 | 106.0 | 100.0 | 105.0 | 96.0 | 90.0 |
| Automobiles | 47.9 | 57.9 | 47.9 | 46.8 | 53.0 | 48.7 | 44.5 | 42.0 |
| Buildings | 18.2 | 18.8 | 22.9 | 16.2 | 19.8 | 21.5 | 22.6 | 17.1 |
| Commercial ships | 1.2 | 1.8 | 1.1 | 1.1 | 0.7 | 1.8 | 0.8 | 0.9 |
| Locomotives | 2.8 | 2.7 | 3.4 | 3.7 | 1.5 | 1.3 | 1.5 | 1.5 |
| Railway cars | 4.0 | 4.4 | 5.0 | 5.0 | 2.2 | 2.6 | 4.2 | 3.5 |
| Railway bearings | 6.3 | 6.7 | 6.9 | 6.9 | 6.4 | 6.1 | 6.5 | 7.0 |
| Manufacturers for export | 30.1 | 27.7 | 20.3 | 25.8 | 25.0 | 27.3 | 30.0 | 25.7 |
| For all other uses | 154.2 | 171.2 | 164.2 | 175.8 | 173.4 | 178.1 | 171.3 | 156.0 |
| Totals | 339.7 | 377.2 | 361.7 | 387.3 | 382.0 | 392.4 | 377.4 | 343.7 |
| Domestic deliveries | 393.6 | 394.2 | 329.4 | 353.8 | 447.3 | 390.3 | 318.8 | 350.4 |

The trend of business with the largest electrical manufacturing companies is steadily upward. In the February 28 issue of ELECTRICAL WORLD there appeared an article on the "Trend of Electrical Sales" with a curve that illustrated graphically this upward tendency. The curve shown gives the combined electrical sales of the Allis-Chalmers Manufacturing Company, the Crocker-Wheeler Company, the General Electric Company, the Western Electric Company and the Westinghouse Electric & Manufacturing Company. The decrea in the use of copper for electrical manufacturers in the third and fourth quarters of 1924 is worth noting, but a general increase in bookings during the fourth quarter presages an increased consumption by this class of manufacturers in the first part of 1925.

### PRODUCTION AMPLE TO MEET DEMAND

Though consumption has given a good account of itself, production has been more than sufficient to meet the demand, and it has been this factor that has had such a restraining effect on prices. The capacity of the world's copper mines and reduction plants is greater than even the present phenomenal demand will absorb, and until this demand overtakes the potential supply, prices are unlikely to advance greatly, for practically all of the larger producers can make a profit in a 15-cent market. With the recent advance in price to 15 cents, which occurred in January, a prompt response was made by United States producers, who increased their output from 75,333 tons in December to 82,149 tons in January.

Certain foreign producers are expected to make material increases in their output in the next year or two, as Chile Copper, Union Minière du Haut Katanga, Bwana M'Kubwa, Andes Copper and Cerro de Pasco. The fir two named have already produced close to 20,000,000 lb. per month each.

Much of the foreign copper comes to the United States for refining, but its amount is not increasing as fast as is the foreign demand, so that a healthy increase is noted in the exportable surplus. A movement is on foot to place a tariff of from 2 cents to 5 cents a pound on copper, but so long as this exportable surplus keeps at present dimensions, such a tariff could hardly be any more effective than is that for zinc. The following figures will prove informative on this point:

| | Pounds, in Thousands | | |
|---|---|---|---|
| 1923 | Imports | Exports | Exportable Surplus |
| First quarter | 141,685 | 198,850 | 57,165 |
| Second quarter | 197,999 | 194,500 | —3,499 |
| Third quarter | 194,831 | 210,100 | 15,269 |
| Fourth quarter | 177,556 | 238,500 | 60,944 |
| 1924 | | | |
| First quarter | 206,160 | 271,300 | 65,140 |
| Second quarter | 198,728 | 308,610 | 109,882 |
| Third quarter | 176,887 | 277,860 | 101,173 |
| Fourth quarter | 195,196 | 319,830 | 124,632 |

These figures are compiled from United States Department of Commerce bulletins and include all copper-bearing material reported, brass being considered as 80 per cent copper.

### ALUMINUM AS A SUBSTITUTE

If the price of copper should go much above its present level aluminum would be used as a substitute in a large number of foreign installations and to a lesser extent, probably, in this country. At the present price of 28 cents for 99 per cent grade, aluminum is considered to be rather high compared with copper, and the price would seem likely to recede rather than to advance, though it is much more closely controlled than is copper. It is protected by a tariff of 9 cents a pound on aluminum sheets, bars and rods and 5 cents on ingots. The Aluminum

Company of America probably would like to see the 9-cent duty raised, but not the 5-cent duty, as it is the heaviest importer, largely from Norway, and directs its selling efforts to marketing in a highly finished form. Under the conditions that have obtained recently no aluminum to speak of has passed either way between the United States and Germany.

Aluminum production has greatly increased in the last ten years. In 1913 the world's production was only 63,800 metric tons, but it is estimated that by next year requirements will be about 250,000 tons. In general producers have been operating at capacity, with frequent extensions being made to the plants in this country, Canada, Germany, Switzerland and France. The use of aluminum cables with steel reinforcement for electrical transmission has been one of the principal outlets, though automobiles have been responsible for a large quantity, and the development of light alloys for aviation purposes is more and more a factor. Apparently plenty of bauxite is available, for large undeveloped deposits exist in various sections of the world, so that there need be no fear of a shortage of aluminum for some time.

# Business Conditions

ORDERS continue to be received in good volume by electrical manufacturers for small general purpose motors and control apparatus. Central-station inquiries for power house equipment, switching apparatus, etc., have fallen off this week, but much apparatus previously quoted on has yet to be ordered. Manufacturers are optimistic and expect very good buying by utility companies owing to the large construction budgets that have been approved. Orders for pole-line construction material is reported as being received in steady volume, particularly from the Southeast, and export sales of this class of material are good. A large manufacturer reports that contracts for fans closed by him so far this year are at a better rate than last year and the belief has been expressed that, regardless of the weather, the sales of fans will be better than last year owing to the improved financial position of industry.

The General Electric Company has announced the sale of a large amount of electric motors and generating equipment to the Carnegie Steel Company. Good sales to steel mills have been generally reported by electrical manufacturers. The United States Steel Corporation has reported an increase of 247,448 tons in the volume of unfilled orders on its books at the end of February. This gain is much larger than was expected and is viewed very favorably. Buying of steel is still conservative, but new business being placed is responsible for the better showing.

In New England there is a noted increase in lighting contracts and many orders for electrical supplies are being placed, though in small quantity. Prospects are bright for the sale of industrial electric furnaces in that district. The demand for small general purpose motors is continuing in good volume in the New York district. In the Southeast electrification plans that have been under consideration by industrial plants are beginning to materialize and a brisk activity is reported in the sales of electrical construction materials. Mild weather is stimulating construction in the Middle West. Utility companies have resumed purchasing apparatus in that section and, in addition to some good maintenance purchases, have placed orders that include a 77,000-kw. turbo-generator, a 40,000-kw. synchronous frequency changer and distribution transformers, meters, etc. On the Pacific Coast building construction activity has increased with the cessation of inclement weather. A five-million-dollar peach crop predicted for the Sacramento Valley is expected to produce profitable business from that section.

## Hisey-Wolf Machine Company Reduces Prices on Electric Tools

PRICES on Hisey electric tools have been reduced, effective February 16, by the Hisey-Wolf Machine Company, Cincinnati, Ohio, manufacturer of portable electric machine tools. A new price list, No. 30, has been issued. The company announces that increased production, necessitated by the demand for its products, has made it possible to reduce the price of many machines. Electric drills of the most popular sizes have been reduced from 12½ per cent to 17 per cent and many other price reductions are said to have been made, ranging from 5 to 10 per cent.

## More Inquiries Being Received for Boilers—Competition Keen

BOILER manufacturers report that inquiries are being received at a much greater rate than was the case during the last six months. One company believes that early in April will see the shop capacity of the boiler manufacturers up to normal, and the general opinion is that 1925 will produce good business. With the increasing use of central-station power there has been a reduction in the number of isolated power-plant installations, but as such plants require heating installations the result has been a shifting in the type of product needed.

Deliveries of standard boilers are very good because during recent months many manufacturers have been forced to build standard-sized boilers for stock in order to maintain their production. Boilers of special sizes and larger boilers require a longer time for delivery because the manufacturer must first secure his material, then fabricate it. Shipments of steel are now becoming slower as the mills are becoming busier. At the present time prices are low because of the highly competitive condition of the market. Some price increases have been made to offset the increase in the price of plates, but the increased steel prices have generally had little effect on the selling price of boilers because most manufacturers are protected against such advances by contracts and also because of the intensive competition.

## French Electrical Manufacturers Optimistic as to Future

FRENCH manufacturers of electrical machinery are optimistic as to the forthcoming market for their products, W. K. Ray, assistant trade commissioner, advises the Department of Commerce. A continued program of railway and rural electrification is expected to assure a good demand for this class of equipment. There is a good demand for electrical household appliances, but large production has produced keen competition and considerable price cutting.

## Swedish Electrical Industry Shows Marked Improvement

THE Allmanna Svenska Elektriska Aktiebolaget (A.S.E.A.), one of the largest electrical manufacturers in Europe, has submitted its annual financial statement for the year 1924, showing a net profit of 2,031,688 crowns after writing off for depreciation 1,252,000 crowns and for taxes 550,000 crowns. The result of the 1924 operations of this important Swedish industry indicates a very marked improvement over the last three years. For 1919 this company paid a dividend of 12 per cent and for 1920 6 per cent, since which year no dividends have been declared. Very large losses were suffered in 1921 and 1922, amounting to 11,830,000 crowns and 12,480,000 crowns respectively.

## Electrical Industry in Germany in an Unfavorable Position

THE position of the electrical industry in Germany is very unfavorable, and although domestic business has improved to a certain extent, export trade is at a standstill, according to the American Chamber of Commerce in Berlin. This is said to be due to the business situation in a number of oversea countries, as, for instance, in the Argentine, South Africa and India, which, after having been rather good marketing fields for electrical goods, are now suffering from a general business depression. The price level of electrical manufactures in these oversea countries is below the manufacturing cost, owing to German goods having been sold at very reduced prices by firms seeking an outlet at any cost. As a result of this proceeding German firms now have difficulty in selling electrical products at standard prices.

German manufacturers are said to be now placing hope in the progressing commercial treaties with various countries, which may affect trade favorably, in electrical goods especially. It is stated, however, that there is little chance for improvement because German wages are on the increase, which will therefore tend further to increase prices of German products. Exports of electrical manufacturers compared with those before the war have decreased by 25 per cent, and it can be

said that the outlook for the future is somewhat unfavorable. Japan, which has not failed to develop her own electrical industry during the war, has been able to capture part of former German marketing territory, especially in India, Australia and South Africa. The great difference between prices offered by German manufacturers and exporters is said to be very harmful in the development of German export trade in general, and in many cases the price level is below that which existed before the war.

## Soviet Government to Buy Much Electrical Equipment in 1925

THE Union of Socialist Soviet Republics, Moscow, has officially announced that the Soviet government will purchase abroad during 1925 electrical products to the value of 16,500,000 rubles (approximately $8,480,000). The government last December placed orders for material in connection with a 130,000-volt transmission line, 120 km. (about 80 miles), long, that will connect the hydro-electric station under construction and known as Bolkovstroi to Leningrad. This new station will have a rating of about 80,000 hp., there being eight Francis-type turbines, built in Sweden. Four of the generators are built by a combination of electrical manufacturing concerns in Russia and four in Sweden.

## Electrical Exports for Last Year Show Gain Over 1923

A SUBSTANTIAL gain in exports of electrical equipment from the United States was registered in the past year, according to an analysis made by the electrical machinery division of the Department of Commerce, total shipments for the year reaching $82,082,000, as compared with $71,647,000 in 1923 and $63,119,000 in 1922. Our exports to countries on the North American continent increased in 1924, as compared with 1923, as they did to South Africa, Australia and New Zealand. The shipments to Asia as a whole increased, the decline in the business to China being more than offset by gains to other Asiatic countries, notably India. While France, Spain and Italy bought more electrical equipment from us than in 1923, the shipments to Europe as a whole decreased. North America also shows a decrease, which is partly explained by the completion in 1923 of a large electrification contract. Shipments to replace material destroyed in the Japanese earthquake largely account for the increase late in 1923 and early in 1924. The last four months of 1924 were below the average for the year.

Exports for the last half of the year were less than for the first six months, this being accounted for by a partial neglect of the foreign market due to domestic demand and increased European competition. Preliminary figures for January, 1925, however, show that the curve has again started upward, although less than for January, 1924. An outstanding feature of this trade is the heavy increased shipments of radio apparatus. Exports of radio apparatus have grown from about $2,900,000 in 1922 to over $6,000,000 in 1924.

## Metal Market Inactive—Prices Decline Slightly

LITTLE interest has been exhibited by consumers in the non-ferrous metal market during the last week, with the result that prices have declined somewhat, though no important changes have taken place. In fact, prices have been maintained unusually well as most of the supplies of metal have been in strong hands. Some resales have been made and speculative lots unloaded, but consumers and traders have been quick to absorb them.

Sales of copper were in fair volume last Thursday and Friday, with producers obtaining 14⅝ cents delivered for April and May shipment. Some odd lots were picked up slightly below this level. On Saturday and Monday consumers would not bid more than 14½ cents and producers would not go below 14⅝ cents, but some business was bocked between these levels. On Tuesday producers came down to 14½ cents, selling a little, and on Wednesday quoted the same without attracting orders, though one seller booked an attractive lot at 14.45 cents. The foreign market has also been quiet.

The official contract price of the American Smelting & Refining Company for lead remains at 9 cents. This was the level at which all lead business appears to have been transacted, but there were rumors that lead could be obtained and was sold below 9 cents.

NEW YORK METAL MARKET PRICES

| | Mar. 4, 1925 Cents per Pound | Mar. 11, 1925 Cents per Pound |
|---|---|---|
| Copper, electrolytic | 14.6 | 14.45 |
| Lead, Am. S. & R. price | 9 | 9 |
| Antimony | 17¾ | 16¾ |
| Nickel, ingot | 31 | 31 |
| Zinc, spot | 7¼ | 7.65 |
| Tin, Straits | 55.30 | *53¼ |
| Aluminum, 98 to 99 per cent | 28 | 28 |

Sales in the New York district were unusually light with the market a little more active on Monday, Tuesday and Wednesday.

Zinc sales have been better than last week, but the volume of business has not been sufficient to prevent prices declining. At present levels traders have shown an inclination to purchase the free supplies, and galvanizers have indicated that they would buy a comparatively large tonnage at 7¼ cents (St. Louis). Owing to activity in the tin market last week, which enabled many customers to satisfy their current requirements, the demand for tin has been dull.

## Industrial Orders in Good Volume in New York District

SEVERAL manufacturers report that the demand for small general purpose motors and general supply lines is continuing in good volume in the New York district. Orders are not large, but the buying of various industries is maintaining a good volume. Inquiries by central-station companies for switching apparatus, etc., have fallen off during the last week, but orders covering much apparatus previously quoted on have yet to be placed. One of the inquiries received this week calls for approximately $7,500 worth of bus-bar supports. Manufacturers feel optimistic as to further business because of the very large construction programs outlined by various utility companies. One such company in this district has approved a twenty-million-dollar construction program and is preparing to place inquiries for various materials.

Sales of pole-line construction material are in good volume and orders are being steadily received, say manufacturers, particularly from the Southeast, where construction work is active. Exports of this class of material have also been good. Orders received from dealers, jobbers and contractors have very much improved since the beginning of March. The demand has been well diversified as to material. Contracts for fans are coming in, says one manufacturer, at a rate ahead of last year, and the belief is current that, regardless of the weather, good sales should be the rule owing to the better financial position of industry in general.

## Lighting Business Gains in New England District

WHILE many inquiries and negotiations are engaging the attention of both manufacturers and jobbers throughout New England, the actual movement of electrical supplies is confined in the most part to small orders. This condition of the market is generally attributed to the uncertainty that exists relative to an early amicable adjustment of the Boston building trades wage scale, which terminates under the old agreement on April 1. An encouraging activity is reported in several lines of supplies. There is a strong increasing trend in lighting contracts. An increase of 16 per cent in the number of new customers is reported for January and February, 1925, as compared with the corresponding months in 1924 by the Boston Edison company. Negotiations are reported to be under way for closing several large wiring contracts for a number of hospitals and new apartment houses. The daily output of incandescent lamps will be increased from 90,000 to 125,000 at the East Boston plant of the Edison Lamp Works of the General Electric Company by expansion of the factory.

Storage batteries for automobile and radio use are in good demand. A prominent agent is planning to distribute 125,000 storage batteries in 1925; another agent records an increase of 30 per cent for the first two months of 1925 as compared with the same period of 1924, and in another case sales are expected to exceed 30,000 batteries. There is a steady demand for small motors, and the prospects appear bright for an exceedingly good year in the sale of industrial electric furnaces. Several inquiries are reported for large power apparatus and electrical supplies for substations, and spring construction projects are moving well. During the past week fifteen cars of iron conduit pipe for interior wiring projects were ordered, and a good volume of sales of cross-arms and poles is recorded. Sev-

eral mills which specialize in coarse fabrics for the automobile trade are running on overtime and are arranging to replace and expand their electrical equipment.

### Mild Weather Helps Construction in the Middle West

BUSINESS in most parts of the Middle West has improved. While the volume is not exceptional, optimism is prevalent, and indications point to a gradual increase of sales. The present mild weather has permitted construction work of the various utility companies to be started. Several interesting contracts for substation buildings in the Chicago district were placed this week, and a twenty-five-million-dollar construction program has been outlined. Purchasing of apparatus by the utility companies was resumed to a certain extent. Orders for a 77,000-kw. turbo-generator, a 40,000-kw. synchronous frequency changer and for distribution transformers, meters, etc., were recently placed. Maintenance purchases have also helped materially to swell the volume of business.

Jobbers in most cases have had better sales. The volume of sales has been quite satisfactory and well diversified. Considerable business was transacted in weatherproof wire and conduit, while in the Chicago district alone one jobber received an order for $10,000 worth of transformers for one of the city parks. Appliance sales have quickened somewhat, but the demand for radio is slow. Prices remain firm, with a few minor readjustments.

### Industrial Plants Electrifying in the Southeast

ELECTRIFICATION plans that have been under consideration by industrial plants in the Southeast are beginning to materialize, and jobbers report a brisk activity in all lines of electrical construction materials entering into such plants, with textile plants the most active buyers. This activity is also stimulating sales of motors up to 50 hp., with very satisfactory orders reported in special textile mill types. There is a marked tendency toward the four-frame and individual drives as against the group drive of several years ago. High-tension transformer equipment is in good demand in this territory in sizes of from 50 kva. to 1,000 kva., with prospects excellent for a heavy movement of this equipment by early fall.

Extensions and improvements by central-station companies are being carried on actively by nearly all of the larger companies, with resultant heavy orders for poles, pole-line materials and conductors. One of the moderate-sized power companies has just announced an expansion and improvement program which will involve an expenditure of $800,000 during 1925. Sales of appliances to central-station companies are improving and ranges are being ordered in anticipation of a good spring demand. Orders from small contractors and dealers are still somewhat slow, with the exception of the Birmingham district and the State of Florida, where all lines of electrical business are very active.

### Building Construction Active on Pacific Coast

BUILDING construction has noticeably increased on the Pacific Coast with the cessation of inclement weather. Well-assorted and fairly large stock orders are reported. Several large hotels and hotel annexes are planned for San Francisco, work on which is to begin within the next month or so, and much residence construction is underway in the Puget Sound district. Recent orders from power companies include 200,000 ft. of ⅜-in. guy strand, 25,000 plug fuses, 10,000 ft. No. 8 single-conductor, 3,000-volt varnished cambric cable; five carloads of poles, 500 assorted bell and furnace transformers, $1,800 worth of four-conductor annunciator cable and several 2,000-lb. and 3,000-lb. orders for copper wire.

There have been several orders received for complete electrical equipment for gasoline service stations, and more business is expected from this source. Fresno packing plants contributed a $1,000 order for assorted wiring supplies, and railroad purchasing has been good. It is predicted that the Sacramento Valley peaches will earn about $5,000,000 this year, thus again making a profitable territory out of a district that has had a couple of lean years. Range business is good, with increasing interest in automatic styles. Heavy-duty heaters are also selling well, particular attention being now paid to the business possibilities of schools and halls. Export business is improving. Some improvement in orders for lumber has been reported by Puget Sound mills, but a four-day week is being seriously considered to supersede the existing five-day-week schedule. Production is being decreased under the existing arrangement and prices are stabilizing, the tendency being upward.

# Activities of the Trade

### Square D Company Enlarges Plant Facilities

The Square D Company, Detroit, manufacturer of electrical safety devices, has just purchased an addition to its main plant at Detroit, which will enlarge its present floor space by 25 per cent. T. J. Kauffman, general manager of the company, in announcing the purchase of the property, states that increasing business has made it necessary to increase production facilities. Mr. Kauffman further states that there is every indication that the company's business during 1925 will exceed that of 1924, which was the best year in its history.

### School of Lighting at Cleveland Issues New Booklets

An outline of the facilities for observation and instruction at the Nela School of Lighting of the National Lamp Works of the General Electric Company at Nela Park, Cleveland, is contained in four booklets recently issued. The titles of these books are: "The Nela School of Lighting," "Light and Vision," "Motor Car Lighting Voltages" and "Automobile Head Lighting." These booklets cover in an interesting and instructive way the general problem of light and vision and the specific problems of the application of lighting to commercial, industrial and street lighting as well as electrical advertising and the wide field of miniature lamp applications.

### Railway & Industrial Engineering Makes Test on New Switch

The Railway & Industrial Engineering Company, Greensburg, Pa., manufacturer of transmission, switching and protective equipment, announces that a group of engineers from large Eastern power companies interested in the 220-kv. superpower developments recently witnessed at the factory a performance test of a three-pole, motor-operated, 220-kv. vertical break disconnecting switch. The switching equipment was run continuously for twenty-four hours, requiring ten seconds to open and nine seconds to close, and subsequent to the twenty-four-hour performance the equipment was operated for one hour at double speed.

### General Electric Receives Order from Carnegie Steel Company

The Carnegie Steel Company recently placed an order with the General Electric Company for a large amount of electric motors and generating equipment for use in the McDonald Mills at Youngstown, Ohio. This equipment includes two 15,000-kw. turbo-generators with direct-connected exciters, five 6,600-volt, adjustable speed, mill type induction motors ranging from 1,125 hp. to 2,200 hp., and two 2,500-hp., 6,600-volt, constant speed, mill type induction motors. The adjustable speed motors are to be furnished with Scherbius speed regulating equipment similar to control of the same type now installed in other mills of this company.

### New England Mills Company Elects New Officers

The New England Mills Company, 849 West Washington Boulevard, Chicago, wholesaler and distributor of radio apparatus, automobile accessories and tires, announces that Albert L. Arenberg has been elected president. Mr. Arenberg was formerly manager of the lighting division of the Central Electric Company, Chicago. The company further states that the activities of the radio division will be enlarged through the addition of salesmen and radio engineers calling on the dealer trade and that further announcements will shortly be made regarding an electrical specialties and lighting division. Other elections and appointments announced by the company are Clyde A.

Horn, vice-president; Edmund F. Dunn, general superintendent; Edward M. Bird, office manager; John N. Levick, advertising manager, and Charles H. Ramp, auditor.

**The Hill Clutch Machine & Foundry Company,** Cleveland, manufacturer of spur gear speed transformers, friction clutches, etc., has recently appointed T. L. Rose & Son as its representative in Pittsburgh and adjacent territory. Mr. Rose has been prominently identified in the power transmission field for more than twenty-five years.

**The Trico Fuse Manufacturing Company,** Milwaukee, Wis., announces the appointment of William T. Clark on its engineering staff. Mr. Clark will devote the greater part of his time to user service problems.

**The Ideal Electric & Manufacturing Company,** Mansfield, Ohio, manufacturer of direct and alternating current power apparatus, announces the reopening of its San Francisco office at 611 Howard Street, in charge of A. J. Myers.

**Charles F. Seymour,** Swarthmore, Pa., has placed on the market an electric erasing machine for the use of draftsmen who make extensive alterations on tracing cloth or paper.

**T. S. Wood,** formerly in charge of the switchboard department of the Westinghouse Electric & Manufacturing Company, in the southeastern territory, with headquarters at Atlanta, Ga., has entered the sales engineering field for the northwest, with headquarters at Seattle, Washington. Mr. Wood will represent various companies, among which are included the Packard Electric Company, the Johnson Manufacturing Company and the Automatic Reclosing Circuit Breaker Company.

**The Haber Electrical Appliance Company,** 866 West North Avenue, Chicago, is now placing on the market a new toaster with "Pyrex" glass panels in the sides and which toasts the bread on both sides at the same time.

**The Kohler Company,** Kohler, Wis., manufacturer of farm-lighting and portable electric power plants, has awarded contracts for the erection of a two-story addition, to cost $65,000.

**The Karl Andren Company,** 250 Congress Street, Boston, has been appointed New England distributor for the Robbins & Myers Company, Springfield, Ohio. The new agency plans not only to engage in the sale of motors and equipment but also to render service in repair and maintenance.

**The Electrical Research & Manufacturing Company,** Waterloo, Iowa, recently organized and incorporated by C. A. Castle and associates, has a complete plant and equipment and will specialize in the manufacture of electrical specialties and appliances. It is also planned to build electrical equipment for various sales corporations.

**The Hoover Company,** North Canton, Ohio, manufacturer of vacuum cleaners, announces a spring window display contest open to all dealers in the United States and Canada, closing May 15.

**The Crocker-Wheeler Company,** Ampere, N. J., announces that its Pittsburgh office, in charge of J. R. Lewis, will move from the Henry W. Oliver Building, to the Dravo Building, 300 Pennsylvania Avenue. A warehouse in which a stock of from 100 to 150 motors will be carried will be operated in connection with this office.

**The Magnavox Company,** Oakland, Cal., has added to its line of heaters the HF3 (2,000-watt) and HF4 (2,650-watt) fireplace types. They are made for 110-volt or 220-volt service.

**The General Furnace Corporation,** 1015 Chestnut Street, Philadelphia, announces the closing of the Boston office, formerly at 80 Federal Street. In the future the business of the New England district will be handled from the New York office of this company.

# New Equipment Available

## Meters and Instruments

Three new types and two improvements to existing types are among the recent developments in the various lines of meters and instruments marketed by the General Electric Company. The new devices are a totalizing watt-hour meter, a three-element, four-wire, three-phase watt-hour meter and a complete line of alternating-current and direct-current switchboard instruments. Improvements include a modified terminal assembly for three-wire, single-phase watt-hour meters and a new contact device for watt-hour meters when used with demand meters.

The new totalizing form of watt-hour meter is designed to meet special problems, such as the determination of the combined maximum demand of completely separate circuits. This meter will totalize four separate polyphase circuits and they may be used on either three-wire, three-phase, or four-wire, three-phase systems. The three-element, four-wire, three-phase watt-hour meter was developed to provide a device which will not be dependent on a balanced condition of voltage for correct registration.

The new line of switchboard instruments are round pattern, and of 7½-in. diameter, with a long and open scale. The complete line includes alternating-current and direct-current ammeters and voltmeters, single-phase and polyphase wattmeters, power-factor and frequency meters and synchronism indicators. The alternating-current instruments bear the type designation "AR-2," and the direct-current "DR-2."

## Wattless Component Meters

A line of wattless component meters for single-phase circuits, for three-phase balanced load circuits, for two-phase circuits, for three-phase three-wire circuits with unbalanced loads and for three-phase four-wire circuits with unbalanced loads has been placed on the market by Landis & Gyr, Zug, Switzerland through their agents L. H. Junod & Company, 104 Fifth Avenue, New York. These meters are induction type motor meters and are constructed in a manner similar to watt-hour meters for the same kind of electric circuit. The only difference between these two types of instruments consists in the phase relation between the magnetic fluxes, as in the wattless component meter the flux from the coil energized at the full pressure lags to such an extent that there is a phase displacement of 180 deg. between this field and the applied pressure producing it.

These meters are calibrated in kilovolt-ampere-hours $\times \sin \theta$ and record the wattless component consumption at all power factors met with in practice with approximately the same exactitude as a standard watt-hour meter. The other characteristics of these meters are similar to those of the watt-hour meters, with the only exception that the watts consumption in the pressure coil and variations in accuracy with fluctuations of the pressure and frequency are a little greater.

## Fractional Horsepower Motor

A fractional horsepower motor with a wool yarn system of lubrication has been developed by the Century Electric Company, St. Louis. This system of lubrication is said to reduce the attention necessary to insure the satisfactory operation of motors which are ordinarily neglected for long periods of time or subject to freezing temperatures. The wool yarn, which is made up of continuous unbroken strands, holds in suspension sufficient oil to lubricate properly a fractional horsepower motor for one year of continuous twenty-four-hour per day operation. In addition, it eliminates the danger of leaks from the oil well, and because of capillary activity and the filtering properties of pure wool yarn, all oil is completely filtered through the yarn fiber before delivery to the bearing surfaces.

## Low-Speed Synchronous Motors

A new type of synchronous motor has recently been developed by the General Electric Company for direct drive of low-speed reciprocating compressors. These motors, known as the type "TS," are being built in more than 300 standard ratings larger than 20 hp. at 60-cycle synchronous speeds between 72 r.p.m., and 450 r.p.m. They are given a maximum rating at a temperature rise of 50 deg. C. These motors are said to have been carefully designed to obtain extreme simplicity of the starting operation, starting conditions satisfactory to the power company, adequate torques, efficient operation and minimum flywheel requirements.

**Show Window Reflector.** — A new porcelain enameled reflector drawn from one piece of steel has been placed on the market by the Wheeler Reflector Company, 275 Congress Street, Boston. It is known as the K-7, and due to its construction is said to be unbreakable. The inner surface of the reflector is white and the outer is gray. It will accommodate either a 75-watt, 100-watt or 150-watt lamp.

# New Trade Literature

FLEXIBLE COUPLINGS. — The Falk Corporation, Milwaukee, is distributing bulletin No. 35, covering the "Falk-Bibby" flexible couplings. They are designed for every purpose and speed and range from ¼ hp. to 20,000 hp. at 100 r.p.m. It gives a description of the method of construction of the couplings and contains tables of sizes and ratings.

AUTOMATIC SWITCHING EQUIPMENT.—The General Electric Company, Schenectady, N. Y., has issued folder No. 67,742-A, covering its automatic switching equipment, distributor supervisory system for control and indication of remote power equipment. It contains illustrations showing the apparatus cabinet, control cabinet and operation of equipment.

SPEED REDUCER.—W. C. Lipe, Inc., 208 South Geddes Street, Syracuse, N. Y., is distributing a bulletin covering the "Lipe" speed reducer, which is applicable for line shafts, air compressors, refrigerating machines, generators, elevators, conveyors, etc. It contains a dimension sheet of standard "Lipe" speed reducers without base.

SPEED REDUCERS.—The Poole Engineering & Machine Company, Baltimore, has issued bulletin No. 105 describing and illustrating the "Poole" type H speed transformer. Bulletin No. 106 covers the "Poole" type K speed transformer. It is adaptable for industrial plants and wherever it is desired to either increase or decrease speeds.

REFRIGERATION. — "Superior Refrigeration" is the title of a folder issued by the Superior Refrigeration, Inc., Wapakoneta, Ohio, describing the "Superior" electrically operated iceless refrigerating machine for use in connection with any good insulated refrigerator having an ice capacity of 75 lb. to 150 lb.

ELECTRIC FANS. — Bulletin No. 143 issued by the Wagner Electric Corporation, 6400 Plymouth Avenue, St. Louis, describes and illustrates the various types of the Wagner fans. It contains a drawing showing thirty-eight features of a three-speed alternating-current oscillating fan, tables of electric and air current data, specifications of various fans, etc.

INSTRUCTIONS FOR SELLING LAMPS. —The National Lamp Works of General Electric Company, Nela Park, Cleveland, is distributing its "Four Star Book" for 1925, which contains instructions for its agents relative to advertising and for merchandising electric lamps. It gives a complete picture of its consumer advertising for the year, offers practical suggestions for tying in with this advertising and building up lamp sales, and shows what it has in the way of material to assist the agents in merchandising lamps properly.

DATA FOR SELLING FANS.—"Going After the 1925 Fan Business" is the title of a booklet issued by the Robbins & Myers Company, Springfield, Ohio, which provides selling helps to agents for selling fans. It contains specimens of folders and booklets for distribution.

WIRES AND CABLES.—"The Simplex Manual" is the title of a new catalog issued by the Simplex Wire & Cable Company, 201 Devonshire Street, Boston, covering the various Simplex wires and cables. The booklet contains tables and several pages of data for the ready reference of electrical engineers, contractors and wiremen.

# Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in South Africa (No. 14,019) of automobile accessories, including batteries; also (No. 13,982) of ice-making machinery.

Purchase is desired in Switzerland (No. 14,010) of high-grade radio sets and parts.

An agency is desired in Belgium (No. 14,007) for small electrical machinery.

An agency is desired in England (No. 13,978) for electrical engineering machinery; (No. 14,011) for radio sets and parts, high grade.

An agency is desired in France (No. 13,985) for excavating machinery, cranes, pumps and steam engines; (No. 14,009) for electrical equipment and machinery.

Purchased is desired in the Kingdom of Iraq (No. 14,027) of storage batteries and spark plugs.

Purchase is desired in Campbellton, Canada (No. 13,876), of electrical advertising signs.

An agency is desired in Calcutta, India (No. 13,877), for electric automobile lamps.

Purchase is desired in Antung, China (No. 13,881), of light and power plant equipment, including generator and accessories.

Purchase is desired in Frankfort, Germany (No. 13,882), of radio sets and parts.

# New Incorporations

THE BLACK RIVER POWER & DEVELOPMENT COMPANY, Leeper, Mo., has been chartered with a capital stock of $75,000 by A. T. Brewster, Ironton; W. H. Meredith and J. H. Hines, both of Popular Bluff, Mo.

THE VINITA (OKLA.) ELECTRIC COMPANY has been incorporated with a capital stock of $20,000 by D. E. and W. H. Emmons.

THE ST. JAMES ELECTRIC LIGHT & POWER COMPANY, Newton (R. F. D.), N. C., has been incorporated with a capital stock of $100,000 by D. E. Isenhower and C. E. Smyre.

THE GOWER ELECTRIC SERVICE COMPANY, Greenville, S. C., has been chartered with a capital stock of $20,000. The officers are: T. Charles Gower, 101 Prentiss Avenue, president, and J. O. Jones, secretary.

# Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

## *New England States*

RUMFORD, ME.—Bids are being asked by the Community Hospital Association for construction of a hospital building, nurses' home and power house, to cost about $300,000. Rogers & Dion, 142 Berkeley Street, Boston, are architects.

ATHOL, MASS. — The Wilcox Novelty Company, contemplates the installation of electric power equipment in the proposed addition to its celluloid manufacturing plant, to cost about $100,000.

CONTOOCOOK, N. H.—The New Hampshire Power Company, has been granted permission to erect a transmission line from Contoocook across Merrimac County, through the towns of Louden and Chichester, where it will connect with the lines of the Pittsfield (Mass.) Light & Power Company.

## *Middle Atlantic States*

BROOKLYN, N. Y.—The Department of Public Markets plans to install electric power equipment in the proposed public market building to be erected on the Wallabout Market site, to cost about $5,000,000.

ELLENBURGH, N. Y.—Norman I. White, owner of the local electric plant, which serves Ellenburgh, Mooers and Altoona with electricity, has applied to the Public Service Commission for permission to sell his plant to the Champlain (N. Y.) Electric Company in order that the service may be extended.

MIDDLETOWN, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until April 1, for a telephone system for the Middletown State Hospital.

MORRIS PARK, N. Y.—The Long Island Railroad Company, Pennsylvania Terminal, New York, plans to install electric power equipment in connection with the proposed rebuilding of its local repair shops, recently destroyed by fire, with a loss of about $500,000.

NARROWSBURGH, N. Y.—The Tunsten Light & Power Company has petitioned the Public Service Commission for approval of franchises granted by the Town Boards of Cochecton and Highland, and also for permission to begin work on erection of transmission lines to serve the above towns.

NIAGARA FALLS, N. Y.—The Niagara Lockport & Ontario Power Company, Buffalo, has acquired the plants of the Pettebone Cataract Paper Company and the Cataract City Milling Company, both located in the hydraulic basin district. It is planned to operate both mills by electricity.

QUEENS, N. Y.—Bids, it is reported, will soon be asked by the City of New York Fire Department, 1132 Municipal Building, New York, for a fire-alarm central station on Myrtle Avenue, to cost about $130,000. J. R. Sliney, 135 St. Edward Street, Brooklyn, is architect.

REMSEN, N. Y.—The Utica (N. Y.) Gas & Electric Company has petitioned the Public Service Commission for permission to extend its transmission lines to serve the town and village of Remsen and exercise franchises granted by the town and village boards.

SYRACUSE, N. Y.—The Syracuse Lighting Company, Inc., has petitioned the Public Service Commission for permission to exercise franchises granted by the Board of Trustees of Cleveland and the town boards of West Monroe, Constantia and Hastings.

ATLANTIC CITY, N. J.—Plans are under consideration by Director of Public Safety for the installation of a new lighting system for the boardwalk.

JAMESBURG, N. J.—The Eastern Jersey Power Company, Asbury Park, plans to erect additional transmission lines in this section for service in various districts, and also a transmission line from Allenhurst to Cranbury Station.

PERTH AMBOY, N. J.—The installation of an ornamental lighting system on the new bridge now in course of construction over the Raritan River, between Perth Amboy and South Amboy, is under consideration by the State Highway Department, Trenton. The plans call for 144 600-cp. lamps, mounted on ornamental brackets.

BROOKVILLE, PA.—A special election will be held on March 17, to vote on the proposal to issue $100,000 in bonds for the purchase of the local light and power plant of the Solar Electric Company, to be owned and operated by the municipality. If taken over extensions and improvements will be made.

KINGSTON, PA.—George P. Steinhauer & Sons are planning to install electric power equipment in connection with the proposed rebuilding of their planing mills and lumber plant, recently damaged by fire with loss of about $150,000.

MIFFLIN, PA. — The Lower Mifflin, Franklin, Toboyne and Perry & Light & Power Companies are being organized to build transmission lines in the respective townships for which they are named. James C. Jones, Bullitt Building, Philadelphia, represents the organizations.

PITTSBURGH, PA. — The Duquesne Light Company is considering the installation of an additional generating unit at its Colfax generating plant.

PITTSBURGH, PA.—A petition has been presented to the City Council by six civic organizations in the Beechview district asking for the installation of a new street-lighting system along Beechwood Avenue, from Peach Way to Hampshire Avenue, and on Broadway, from Hampshire to Neeld Avenue.

FAIRMOUNT, W. VA.—The Monongahela West Penn Public Service Company contemplates extending its service to Mount Clare and Lost Creek.

WASHINGTON, D. C.—Bids will be received by the General Supply Committee, Washington, until April 8, for incandescent electric lamps, as required during the fiscal year 1925 (Class 15).

WASHINGTON, D. C.—Bids will be received by the Chief of the Bureau of Yards and Docks, Navy Department, Washington, until March 25, for switchboard and changes in electric wiring at the local naval hospital, Medical School, (Specification 5079).

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, as follows: Until March 17, for 80 switchboard sockets, 2 telephones, 145 desk stand boxes, mounting plates, lamp caps, etc. (Circular C. P. 20323-3); for 10,560 ft. submarine cable, paper insulated, single wire armored, 10 pr.; 10,560 ft. cable, 20 pr., and 10,560 ft. cable, 25 pr. (Circular C. P. 20403-2); Until March 19, for radio receivers and transmitters (Circular C. P. 20014-I); Until March 20, for battery equipment boxes (Circular C. P. 20014-6); Until March 23, for dynamotors (Circular C. P. 19005-3); and until March

24, for armoring 52,800 ft. of cable and 20 reels (Circular C. P. 20403-1).

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until March 27, for electrical equipment, including four spot and floodlights, 25 fans, 50 renewable fuses, 36,000 flashlight dry cells, 50,000 ft. rubber insulated wire, magnet wire, etc. (Panama Circular 1659).

## North Central States

BROWN CITY, MICH.—The Great Lakes Power Company, Caro, is negotiating for the municipal lighting system and plans to furnish service here. Extensions and improvements are under consideration.

HILLSDALE, MICH.—Work will start on an extension of the ornamental lighting system from the business section to the residential districts as soon as the weather will permit.

MANISTEE, MICH. — Plans are under consideration by the City Commission to replace the present lighting system in the downtown district with ornamental lamps.

SUNFIELD, MICH. — The Consumers Power Company, Jackson, plans to build a transmission line, to furnish service in Sunfield, Woodland, Vermontville and Lake Odessa. The cost is estimated at $50,000.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until March 20 for substation switching equipment for the Division of Light and Power.

EAST YOUNGSTOWN, OHIO.—The City Council is considering the installation of a new street-lighting system.

SANDUSKY, OHIO. — The Ohio Public Service Company, Cleveland, plans to erect a local outdoor transformer station to cost about $30,000.

BOWLING GREEN, KY. — Steps have been taken by the Kiwanis Club to secure an extension of the ornamental lighting system on College Street to Fourth Street and thence to the station.

HAZARD, KY.—Plans are under way by the Kentucky & West Virginia Power Company for an extension to its boiler room and the installation of two additional boilers and addition to the coal room. The cost is estimated at $100,000. Right of way has been secured by the company for a transmission line to Betsey Lane, this being part of the plan to connect up all its power plants.

MOUNT OLIVET, KY. — The Kentucky Power Company, Augusta, has acquired the local electric plant and will furnish service here. Extensions in transmission lines are planned.

EAST CHICAGO, IND.—Bids will be received by the Board of Public Works until March 18 for construction of the Alder Street sewage pumping station with equipment and accessories. Pearse, Greeley & Hansen, 6 North Michigan Avenue, Chicago, are engineers.

INDIANAPOLIS, IND.—The Merchants Heat & Light Company will soon begin rebuilding the street-lighting system, in accordance with its contract with the city, covering the installation of 225 lamp standards on important streets in the business section, and improved lamps in the residential district. The cost is estimated at $100,000.

NOBLESVILLE, IND.—The City Council has authorized estimates of cost for a proposed municipal electric light and power plant.

CHICAGO, ILL.—The Inland Steel Company is planning electrification of part of its plant at Indiana Harbor, Ind., in connection with extensions and improvements to cost about $8,000,000.

CHICAGO, ILL. — The Wisconsin Steel Works, Torrence Avenue and 106th Street, has taken out a permit to build a transformer station at its plant.

MOLINE, ILL. — Plans have been approved by the property owners' committee for the installation of an ornamental lighting system in the business district. Bids, it is understood, will be soon asked for the work.

CEDARBURG, WIS. — Bonds to the amount of $85,000 have been authorized for extensions and improvements in the municipal electric plant and system.

GREEN BAY, WIS. — The Wisconsin Public Service Corporation is considering extending its transmission lines in Brown County to furnish electricity to a number of farming districts.

MADISON, WIS. — Petitions have been presented to the City Council asking for the installation of ornamental lamps on portions of West Washington Avenue, North Fairchild Street and West Mifflin Street.

MILWAUKEE, WIS.—Negotiations have been completed by the North American Company for the purchase of the hydro-electric power site at Pemene Dam. It has also obtained an option on the Chappie Rapids, located about 5 miles above Marinette. The purchase of the power site at White Rapids, which is estimated will develop about 12,000 hp., is contemplated for which negotiations are under way. It is now being developed and is delivering power to the plant of the Northern Paper Mills Company, at Green Bay, which own the site.

PEMBINE, WIS.—The electric distributing system of the Pembine Light & Power Company has been acquired by the Northeastern Power Company, a subsidiary of the Wisconsin Public Service Corporation, Green Bay. Improvements contemplated include the erection of a high-tension transmission line from Wausaukee to Pembine, a distance of about 20 miles.

PORTAGE, WIS.—Arrangements are being made for the installation of an ornamental lighting system in the business district, to cost about $20,000. C. W. Sheppard, Madison, is engineer.

RACINE, WIS.—Extensions and improvements are contemplated by the Wisconsin Gas & Electric Company to its local system, involving an expenditure of about $500,000.

STOUGHTON, WIS.—A special election will be held on March 16 to vote on the proposal to issue $100,000 in bonds for a new electric light and power plant. Electricity is now generated and distributed from the municipal hydro-electric plants and additional energy is purchased from the Wisconsin Power & Light Company.

SUPERIOR, WIS. — A movement has been started to secure the installation of ornamental lamps on North Fifth Street, from Tower Avenue to Grand Avenue.

WAUSAU, WIS.—An ordinance providing for extension of the ornamental lighting system on West Washington Street has been approved by the Council.

ATWATER, MINN.—The Atwater Light & Power Company plans to extend its transmission line 5 miles into the country districts to serve farmers.

HIBBING, MINN.—Bids will be received by J. L. Golob, recorder, until March 16 for extensions to the municipal electric plant, to cost about $300,000. R. D. Thomas, 1200 Second Avenue, Minneapolis, is engineer.

MINNEAPOLIS, MINN.—The City Council is considering the installation of an ornamental lighting system on Ninth Street between Hennepin and Marquette Avenues. Standards mounted with single lamps of 1,000 cp. will be used.

MINNEAPOLIS, MINN.—Extensions and improvements involving an expenditure of more than $7,000,000 are contemplated by the Northern States Power Company, Chicago, in Minnesota, Wisconsin, North Dakota and South Dakota this year. The work will include an addition to the office building on Fifth Street, improvements to the Aldrich Avenue substation, laying an underground cable from the Aldrich Avenue station to Garfield and Thirty-third Street station and thence to the Pleasant Avenue station at Richfield; improvements to the 75-mile, 110,000-volt transmission line which encircles the Twin Cities and also the erection of a number of new lines in the state; replacing the Oak and Mary Streets station in Minneapolis by the new University substation, rebuilding numerous lines; rebuilding substation at Chaska; and adding a large turbine to steam plant at La Crosse, Wis., etc.

WINTHROP, MINN.—Bids, it is understood, will soon be asked for extensions and improvements in the municipal electric plant, to include the installation of additional equipment. Toltz, King & Day, Inc., Builders' Exchange, St. Paul, are engineers.

LITTLE ROCK, IOWA.—The Northwestern Light & Power Company, Mayville, Wis., is negotiating for the purchase of the municipal lighting system. Improvements are contemplated, including extensions to transmission line.

BAGNELL, MO.—The Missouri Hydro-Electric Power Company, recently organized, has been granted a preliminary permit to build a hydro-electric plant on the Osage River, near Bagnell, to cost about $10,000,000. Walter Graves, president of the Kansas City (Mo.) Joint Stock Land Bank, is president of the Missouri Hydro-Electric Power Company.

KANSAS CITY, MO.—Plans are being considered by the Kansas City Power & Light Company for placing its overhead feeder wires in underground conduit, at a cost of about $250,000.

GENEVA, NEB.—A special election will be held on April 7 to approve a bond issue of $40,000, for the installation of a municipal lighting system.

McCOOK, NEB.—Bonds to the amount of $200,000 have been voted for the construction of a municipal light and power plant.

OMAHA, NEB.—Plans for installing a new lighting system on the Lincoln Highway the entire distance through the city is under consideration.

THURSTON, NEB. — Plans are being considered for the erection of a transmission line from Pender to Thurston to supply electricity here.

## Southern States

FRANKLIN, N. C.—Bids will be received by the Board of Aldermen until March 27 for construction of dam, power house and other buildings at Leopard Bend, on the Little Tennessee River, about 3½ miles north of Franklin. For details see Searchlight Section.

GREELYVILLE, S. C.—The Town Council has engaged the Ryan Engineering Company, Columbia, to make surveys and prepare estimates of cost for a municipal electric plant, waterworks and sewerage plant for the town.

LEXINGTON, S. C.—The Broad River Power Company, Columbia, has acquired the plant and system of the Lexington Light & Power Company. Extensions are planned to transmission lines in this section.

SPARTANBURG, S. C.—Bids will be received by the Commissioners of Public Works until April 14 construction of a new water supply, including dam and power house, with generators, turbines and pumping equipment; complete water purification plant of 6,000,000,000 gallons daily capacity, stand pipe, water mains, etc. P. H. Norcross, Candler Building, Atlanta, Ga., is consulting engineer.

MEMPHIS, TENN.—Permission has been granted the Memphis Electric League Committee to construct an electric fountain at Court Square, to cost about $40,000.

MOBILE, ALA.—Bids will be received by H. T. Hartwell, Mayor, until March 31 for a complete fire-alarm system and extension to police-signal system.

GRETNA, LA.—At an election held recently the proposal to issue $160,000 in bonds to establish a municipal electric plant was defeated.

BUTLER, OKLA.—Bonds to the amount of $10,000 have been voted to make connections with the transmission line to be erected between Elk City and Leedy.

IDABEL, OKLA.—An election will be held March 17 to vote on the proposal to issue $23,000 in bonds for new motor-driven pumps, oil engine, transmission line, etc., for water works system. V. V. Long & Company, Colcord Building, Oklahoma City, are engineers.

MANITOU, OKLA. — The Southwestern Light & Power Company, Lawton, has been granted a franchise to supply electricity in Manitou. It is proposed to erect a line 2½ miles long, from Manitou to connect with the high-tension line between Lawton and Frederick.

HUNTSVILLE, TEX.—Investigations are being made by the Western Public Service Company, Colorado Springs, Col., with a view of building a large central power plant in the lignite fields in this section. The company has taken an option on the electric light plant of the Huntsville Cotton Oil Company.

PANHANDLE, TEX.—At an election to be held March 17 a proposal to issue $35,000 in electric light bonds will be submitted to the voters.

## Pacific and Mountain States

KALAMA, WASH.—Plans are under way by the Puget Sound Power & Light Company, Seattle, for laying a second marine cable across the Columbia River between Kalama, Wash., and Rainer, Ore., to cost about $10,000.

SEATTLE, WASH. — The City Council has approved plans for the installation of improved street-lighting systems on a number of streets, including Olive, East Olive, East John, Howell Streets; and Boren, Minor and Terry Avenues and Melrose Place.

VANCOUVER, WASH.—The City Council has authorized improvements to the street lighting system, to cost about $45,000.

VANCOUVER, WASH. — The Commissioners of Clarke County have granted the Puget Sound Power & Light Company, Seattle, permission to erect transmission lines along thirty-two roads in the northwestern part of the county. This is the last link in a continuous transmission line

from the Canadian border to Vancouver. A connection is planned with the lines of the Portland (Ore.) Railway, Light & Power Company, making a continuous line to the California border.

PORTLAND, ORE.—The Portland Electric Power Company plans to build an addition to its substation on First Street, near Jefferson Street, to cost about $27,500.

ALAMEDA, CAL.—Plans are under consideration by the Alameda Merchants' Association for replacing the present electrolier lighting system on Park Street with new lamps. Joseph B. Kahn is superintendent of the municipal electric plant.

BEVERLY HILLS, CAL.—Plans are being considered by the Board of Trustees to establish new lighting districts lying east and west of present district. The cost is estimated at about $50,000. Street lighting service is furnished by the Southern California Edison Company, Los Angeles.

FRESNO, CAL.—The Pacific Gas & Electric Company, San Francisco, contemplates improvements to its local system, to cost about $333,000.

LOS ANGELES, CAL.—The Southern California Edison Company plans to build a high-voltage substation at the corner of South Park and 108th Streets.

LOS ANGELES, CAL.—Bids will be received by the City Purchasing Agent, City Hall Annex, until March 20, for a quantity of police telephone signal boxes (Specification 1087).

LOS ANGELES, CAL.—Bids will be received by the Public Service Commission, 207 South Broadway, until March 27, for a quantity of distribution and small power transformers (Specification P-347).

LOS ANGELES, CAL.—Plans are under way by the Municipal Bureau of Power and Light for the installation of more than 6 miles of underground cable lines in the downtown retail and wholesale district, at a cost of about $2,000,000. It is proposed to eliminate all overhead lines in that area.

LOS ANGELES, CAL.—The City Council has approved ordinances for the installation of ornamental lighting systems on the following streets: Edgemont Street, using concrete standards; Santa Barbara Avenue, pressed steel standards; Norton Avenue, pressed steel standards; and on Leighton Avenue, concrete standards.

STOCKTON, CAL.—Plans are under consideration for the installation of an improved lighting system on a number of streets. Charles E. Ashburner is city manager.

SAN DIEGO, CAL.—The City Council is considering the installation of ornamental lighting systems on Columbia, State, Union, India, Front, First, Second, B and C Streets. F. A. Rhodes is city manager.

SANTA ROSA, CAL.—Plans are under consideration by the Geysers Development Company to build a 2,500-kw. natural-steam-power plant this summer at the Geysers, 30 miles from here. It is now proposed to wholesale the power generated at the plant.

## *Canada*

LIVERPOOL, B. C.—The Canada Creosoting Company, Toronto, Ontario, contemplates the construction of a power house at its proposed local creosoting works, to cost about $275,000. R. L. Bonham is company engineer.

VICTORIA, B. C.—Extensions and improvements are contemplated by the British Columbia Electric Railway Company this year, to cost about $350,000, of which $173,000 will be used for light and power extensions and $120,000 for replacements.

WINNIPEG, MAN.—Tenders will be received by the City of Winnipeg-Hydro-Electric System, 55 Princess Street, until March 16 for furnishing and installing in the power house at Pointe du Bois, three units of governors for controlling existing horizontal shaft hydraulic turbines directly connected to alternating-current generators.

RENFREW, ONT.—The provincial government has authorized the Hydro-Electric Power Commission of Ontario to proceed with the proposed power development at Roche Fendue Rapids, on the Ottawa River near Renfrew, where it is expected to develop about 65,000 hp. The plant may be located on Calumet Island on the Quebec side of the river. The cost is estimated at from $7,000,000 to $10,000,000. The commission may also develop power at Deschenes Falls, near Ottawa.

THREE RIVERS, QUE.—Plans are under consideration by the United Manufacturing Company for a water power development here, to cost about $6,000,000. W. J. Francis & Company, 260 St. James Street, Montreal, are engineers.

# Electrical Patents

**Announced by U. S. Patent Office**

(Issued February 17, 1925)

1,526,539.. BIFUNCTIONAL STORAGE BATTERY; J. W. Fraser, Cleveland, Ohio. App. filed May 4, 1922. Having the anode on one side of a plate and the cathode on the other; multi-cell type.

1,526,550. TWO-WAY TRANSMISSION WITH REPEATERS; E. D. Johnson, East Orange, N. J. App. filed Feb. 7, 1923. For telephone lines.

1,526,559. WELDER'S TONGS; J. S. Oechsle, Philadelphia, Pa. App. filed Sept. 12, 1923.

1,526,613. DYNAMO-ELECTRIC MACHINE; L. J. Stephenson, Chicago, Ill. App. filed March 12, 1920. Variable-speed motor or variable-voltage generator with other characteristics.

1,526,620. METHOD OF MANUFACTURING DRY CELLS; V. Yngve, South Orange, N. J. App. filed March 28, 1924.

1,526,623. SWITCH; J. W. Berry, Marine City, Mich. App. filed July 1, 1921. For use in connection with a time-controlled mechanism.

1,526,634. RESISTANCE SWITCH; I. F. Gottschalk, N. Y. App. filed Nov. 12, 1923. For use in series with the electric lights in a store, or any place to dim the lights when desired, as for all-night service.

1,526,641. THERMOPILE; H. A. Mulvaney and H. E. Kennedy, Berkeley, Cal. App. filed Aug. 9, 1921.

1,526,644. PROCESS OF ELECTROPLATING AND APPARATUS THEREFOR; G. H. Pinney, South Manchester, Conn. App. filed Oct. 25, 1922.

1,526,649. RESISTANCE DEVICE; A. E. Waller, Bronxville, N. Y. App. filed March 28, 1922. Resistor elements of thin self-supporting strips, such as ribbon bent in the form of a channel.

1,526,683. AUTOMATIC INSTANTANEOUS ELECTRIC WATER HEATER; F. O. Seavey, Newark, N. J. App. filed Sept. 16, 1921.

1,526,691. ELECTRIC LIGHT FIXTURE; H. G. Beyer, Baltimore, Md. App. filed May 2, 1924. For use with various housings for purposes such as advertising, signaling, etc.

1,526,708. RHEOSTAT; L. Kebler, Bronxville, N. Y. App. filed April 8, 1920. Having a series of contacts with adjustable means for controlling the resistance.

1,526,714. RECOVERY AND UTILIZATION OF MATERIALS OF OLD SECONDARY BATTERY PLATES; J. O. Luthy, San Antonio, Tex. App. filed Feb. 28, 1924.

1,526,727. ELECTRIC DEMAND METER; A. J. Twogood, Berkeley, Cal. App. filed May 7, 1917. Watt-hour type.

1,526,747. MAIL BOX WITH AUDIBLE SIGNAL; J. B. Hanson and L. S. Marvin, Atlantic, Iowa. App. filed Oct. 12, 1922.

1,526,755. ELECTRIC SHIP PROPULSION; C. MacMillan, Schenectady, N. Y. App. filed Oct. 27, 1923.

1,526,758, 1,526,759, 1,526,760. ELECTRIC HEATER; P. Rauchfuss, Berlin, Germany. App. filed Nov. 1, 1922. In which the liquid itself forms the heating resistance.

1,526,770. MEANS FOR TESTING FAULTY ELECTRIC LINE INSULATORS AND INDICATING LEAKAGE THEREIN; O. W. Brian, Ashfield, near Sydney, New South Wales, Australia. App. filed May 22, 1923.

1,526,773. ELECTRIC MOTOR DRIVE; F. H. Clough, Hillmorton, near Rugby, England. App. filed June 12, 1922. Applicable to machinery having parts designed to rotate at slightly different speeds.

1,526,778. THERMOPHONE; L. de Forest, New York, N. Y. App. filed March 13, 1920.

1,526,817. ELECTRIC STORAGE BATTERY CONSTRUCTION; F. Wright, Poughkeepsie, N. Y. App. filed April 30, 1923. In which a diaphragm is employed for separating two liquids in such a manner that by their gradual combination through the diaphragm the electric current is produced.

1,526,818. ELECTRICAL CONNECTION FOR OVEN ELEMENTS; J. H. Allen, London, Ontario, Canada. App. filed Oct. 16, 1922.

1,526,823. ELECTRIC BATTERY; R. C. Benner, Fremont, Ohio. App. filed March 11, 1920. Deferred-action type.

1,526,833. ATTACHMENT FOR ELECTRIC STOVES; C. H. Cook, H. J. Lewis and C. E. Lewis, Cleveland, Ohio. App. filed June 30, 1922. Table stove.

1,526,843. ELECTRIC HEATING ELEMENT; M. D. Dominguez, New Orleans, La. App. filed Nov. 22, 1923. Adapted to be placed within a coiled conduit through which liquid may be passed and heated by radiation from the resistance coils.

1,526,852. MEANS FOR AND METHOD OF LIMITING INTERFERENCE IN WIRELESS SIGNALING; J. H. Hammond, Jr., Gloucester, Mass. App. filed Aug. 20, 1917.

1,526,862. BONDING PIN; S. Miskelly, Downers Grove, Ill. App. filed Feb. 28, 1923. For securing track-bonding wires.

1,526,865. ELECTRIC BATTERY; P. E. Norris, Wilkinsburg, Pa. App. filed Jan. 10, 1923. Of the storage type.

1,526,870. SWITCH BOX; A. T. Sampson, Lynn, Mass. App. filed Feb. 6, 1920. For mounting in an overhead position on the conduit.

1,526,889. STORAGE-BATTERY-PLATE SEPARATOR; F. J. West, Winnipeg, Manitoba, Canada. App. filed April 15, 1922.

1,526,939. TELEPHONE CONNECTION; V. W. Spears, Greenwood, Ind. App. filed March 28, 1924. Plug and terminal arrangement.

1,526,980. ELECTRIC MACHINE; C. Hering, Philadelphia, Pa. App. filed June 8, 1923. With multipolar armature windings but without a commutator or more than two brushes so that no armature coils are ever shortcircuited.

1,526,988. POWER PLANT; L. S. Keilholtz and E. Dickey, Dayton, Ohio. App. filed June 19, 1920. Of the farm-lighting type.

1,526,989. ELECTRICAL CIRCUIT CLOSER; C. Kemp, New York, N. Y. App. filed May 5, 1924. For a burglar-alarm system.

1,526,992. AUTOMATIC TELEPHONE SYSTEM; M. Langer, Hermsdorf, near Berlin, Germany. App. filed Sept. 2, 1921.

1,526,996. ELECTRIC RELAY; N. W. McLachlan, Newcastle-on-Tyne, England. App. filed Dec. 13, 1921. Whereby considerable force can be obtained directly from a small current without the employment of contacts for opening and closing an auxiliary circuit.

1,527,027. RECOVERY OF AMMONIUM CHLORIDE; W. H. Dahmen, Yardley, Pa. App. filed May 10, 1924.

1,527,069. PROCESS OR METHOD OF AND APPARATUS FOR MAGNETIC CENTRIFUGAL SEPARATION; O. B. Peck, Jr., Los Angeles, Cal. App. filed Sept. 6, 1923.

1,527,070. MAGNETIC CENTRIFUGAL SEPARATOR; O. B. Peck, Jr., Los Angeles, Cal. App. filed Oct. 3, 1923.

1,527,071. MAGNETIC SEPARATOR; O. B. Peck, Jr., Los Angeles, Cal. App. filed Oct. 3, 1923.

1,527,084. ELECTRODE ARRANGEMENT FOR ELECTRIC WELDING MACHINES; E. Schroder, Berlin, Germany. App. filed Feb. 3, 1922.

1,527,085. ELECTRIC WELDING OR HEATING MACHINE; E. Schroder, Berlin, Germany. App. filed May 22, 1922.

1,527,088. METHOD OF MAKING IRON-CHROMIUM ALLOYS; E. J. Shackelford and W. B. D. Penniman, Baltimore, Md. App. filed Dec. 11, 1924.

1,527,095. METHOD AND APPARATUS FOR COATING; L. C. Turnock, Edgewood, Pa. App. filed Oct. 12, 1923. By electrodeposition.

1,527,137. LIGHTING FIXTURE; C. H. Hofrichter, Cleveland, Ohio. App. filed March 7, 1922. With an adjustable socket.

1,527,140. ELECTRICALLY DRIVEN PERIODICALLY MOVING MECHANISM; C. D. J. Jamin, Jr., Rotterdam, Netherlands. App. filed Sept. 22, 1922. As in clocks.

(Issued February 24, 1925)

1,527,164. ELECTRIC FLATIRON; A. Anderson and M. Deckert, Chicago, Ill. App. filed Nov. 7, 1921.

1,527,171. CONDUCTOR SUPPORT; H. P. Chandler, Mansfield, Ohio. App. filed March 19, 1924. For securing a trolley conductor or wire to an overhead hanger.

1,527,172. WATER HEATER; W. Colebrook (deceased), Durban, Natal, South Africa; by H. M. Colebrook, Harringay, England, and L. A. Neale, Grantham, England, executrices. App. filed Sept. 7, 1923. With conductor disposed around and outside of container of water.

1,527,177. LOADED SIGNALING CONDUCTOR; G. W. Elmen, Leonia, N. J. App. filed Dec. 24, 1920.

1,527,228. METHOD OF HARMONIC OR SUBHARMONIC FREQUENCY PRODUCTION; J. C. Schelleng, East Orange, N. J. App. filed Dec. 29, 1923. In the wireless reception of energy.

1,527,232. ELECTRICAL HEATING UNIT; L. D. Smith, Toledo, Ohio. App. filed Feb. 8, 1924. As used in electric cook stoves, hot plates and the like.

1,527,241. METHOD OF AND MEANS FOR PRODUCING METALLIZED SURFACES ON RUBBER COMPOUNDS CONTAINING SULPHUR; A. I. G. Warren, Caterham Valley, Surrey, England. App. filed Dec. 5, 1922.

1,527,250. CABLE FOR CONVEYANCE OF ELECTRICAL ENERGY WITH GRADUATED INSULATION; Luigi Emanueli, Milan, Italy. App. filed Nov. 22, 1921.

1,527,252. ELECTRIC INCINERATOR; G. J. Rohn and A. Pfau, Jr., Milwaukee, Wis. App. filed Sept. 24, 1923.

# Financial and Corporate

## Utility Stocks Decline

**Weakness in General Markets Since Inaugural Extends to Utilities**

JUST as the inaugural marked a turning point, temporarily at least, in the general markets for stocks, it marked the culmination of a stronger market in power and light stocks and the beginning of more cautious buying. Nothing in the news or in the development of the industry is changed, but markets frequently undergo technical adjustments that have little to do with fundamental situations, and in recent weeks technical movements have controlled prices.

Among the unlisted issues of the power and light group virtually every important price change for the week was a decline, although the recession in no case was sharp. The recessions of the past week about offset the advances of the week before. Traders have been following with considerable interest the decline in Electric Bond & Share Securities Corporation shares, which has been about as spectacular as were some of the upward movements last year. This stock earlier this year sold as high as 105, and some small sales were made at 125, but another three-and-one-half-point loss last week left the stock below 60. The decline, of course, does not represent any change in the outlook of the affairs of this company but is accounted for by a misunderstanding at first of what the new stock is.

Two, three or four-point losses were suffered during the week by such stocks as Adirondack Power & Light, which fell to 36 after establishing a record high above 40; American Power & Light common, Cities Service Electric common, Lehigh Power Securities, National Power & Light common and Southeastern Power & Light common. Fractional advances were achieved by all of the Northern Ohio Power issues, in which interest is broadening, and a two-and-one-half-point gain was recorded for United Gas & Electric common.

## New Capital Issues

The largest single issue of electric light and power securities during the past week was the offering of the Oklahoma Gas & Electric Company in 5 per cent bonds, totaling $23,500,000. The proceeds will be used, with additional funds, to retire all present bonds and notes of the company and its subsidiaries. Another sizable issue consisted in the twelve million-dollar loan of the Midland Utilities Company in the form of 7 per cent cumulative prior lien stocks.

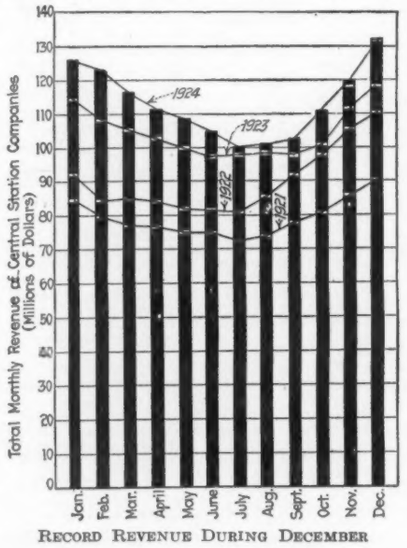
A foreign issue, the fifteen-million-dollar offering of the Toho Electric Power Company, Ltd., was a feature of this week's new financing. The Toho Electric Power Company, operating in two of the most important commercial and industrial sections of Japan, supplies practically without competition electric light and power to over 4,000,000 people in a territory of approximately 4,000 square miles.

The American Power & Light Company was represented with an eight-million-dollar issue of gold debenture bonds offered at 95½ and accrued interest, to yield over 6.25 per cent. Among the other issues brought out during the week were the two-million-dollar offering of the California-Oregon Power Company in first and refunding mortgage 5½ per cent bonds, the one-million-dollar offering of the Northern Indiana Gas & Electric Company in 7 per cent cumulative preferred stock and the preferred stock issue of the Arkansas Light & Power Company totaling 7,000 shares.

## Record Revenue During December

Reports received by the ELECTRICAL WORLD from central-station companies representing 78 per cent of the generator rating of the country indicate that the total gross revenue from the sale of energy during December was $132,200,000, or a daily average of $4,270,000, an increase of 11.2 per cent over December of 1923 and setting a new record in central-station revenue.

Following the usual season trend, the revenue during the month of December showed a material increase over that reported for November. The revenue was 11.7 per cent above the estimated normal for the month. Every section of the country reported revenue above that for the same month of 1923. The operating expenses during December totaled $56,500,000, against $52,300,000 for December of 1923.




RECORD REVENUE DURING DECEMBER

## Annual Reports of Light and Power Companies

The consolidated income statement of the North American Company, whose principal subsidiaries serve Cleveland, Milwaukee and St. Louis with electric light and power, for the year 1924 shows gross earnings of $80,117,255, an increase of $4,651,988, or 6.16 per cent, and net income of $31,840,823, an increase of $3,933,765, or 14.10 per cent. Electric output for the year amounted to 2,328,618,141 kw.-hr., an increase of 175,003,778 kw.-hr., or 8.13 per cent. During the year 46,071 electric customers were added, 644,430 being served on December 31, 1924.

The Public Service Company of Northern Illinois for the year ended December 31, 1924, reported gross operating revenues aggregating $18,003,904, an increase of 12.42 per cent over those of 1923. After charging $803,553 to retirement expense there was available for the payment of interest and dividends $5,861,474. Total sales of electricity amounted to 372,221,963 kw.-hr., as against 344,504,838 the previous year. During the year 30,648 new customers of all classes were added, bringing the total up to 283,629.

The report of the Federal Light & Traction Company for 1924, recently issued, shows consolidated net income of $1,287,622 after taxes, interest and preferred dividends of subsidiaries. The company, after deducting $224,974 for preferred dividends, had a balance for the common stock of $1,062,647, equal to more than $14 a share on the 73,485 no-par-value shares outstanding.

The combined balance sheet of the Consolidated Gas Company of New York and affiliated gas and electric companies for the year ended December 31, 1924, shows gross earnings of $126,459,960, as compared with $123,741,998 the previous year, and net earnings of $35,496,688, against $35,808,770.

The American Light & Traction Company reported for the year 1924 gross earnings of $5,246,273, against $4,510,670 in 1923. Electric sales amounted to 146,467,070 kw.-hr., an increase of 9,314,437 kw.-hr. over 1923. The increase in electric meters totaled 9,063, bringing the total as of December 31 up to 105,051.

In its report for 1924 the New England Company Power System reported gross earnings of $7,173,395, as compared with $7,468,329. The drop in operating expenses from $5,392,850 in 1923 to $4,661,083 in 1924 resulted in an increase in net earnings during the past year—$2,512,312 against $2,075,479.

The annual report of the Central Illinois Public Service Company showed substantial improvements over 1923. Gross earnings including merchandise sales amounted to $8,901,968, an increase of $711,614 over the previous

year. There were installed 67 additional miles of high-tension transmission lines, making a total of 1,725 miles. Aggregate power loads increased 24,900 hp. and aggregate lighting loads 9,290 kw. during this period.

Business of the Calumet Gas & Electric Company and the constituent companies now a part of it aggregated $1,149,565 in 1924, according to the combined earnings statement issued by the company as part of its annual report. The operating revenue of the Calumet Gas & Electric Company alone for the year amounted to $541,640. The balance sheet of the company as of December 31, 1924, shows total assets of $5,925,931. The company now serves sixty-two communities in Northern Indiana, sixty with electric service, one with gas service and one with both electric and gas service.

# New York Edison's Great Development

## Increased Business for This Leading Metropolitan Operator Has More than Doubled Its Earnings Since the Close of the War

BY PAUL WILLARD GARRETT

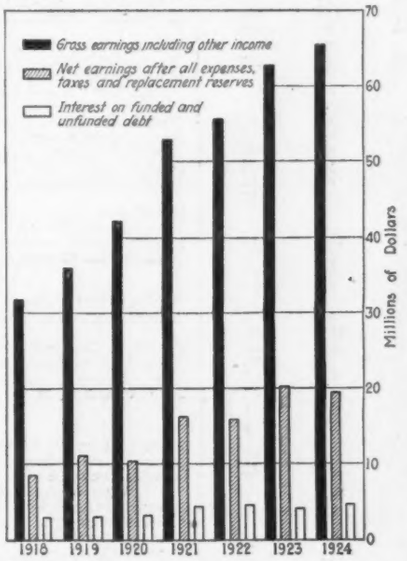
THE combined properties of the New York Edison Company and its principal subsidiary, the United Electric Light & Power Company, constitute one of the largest electric generating and distributing systems in the world. The fact that the system operates in the world's largest city, New York, where it serves the entire Borough of Manhattan and the greater part of the Bronx, makes its growth in recent years particularly significant. Its improvement in earnings affords an excellent index to the increased demand for electric service in a great city, whereas the increases in earnings of holding companies often include revenue from properties added through purchase of control.

The New York Edison Company's gross earnings during 1918, the last year of war, totaled $31,777,168, but a substantial increase has been reported for each subsequent year until in 1924 the total reached a new high figure of $65,404,464. The jump from 1923 to 1924, covering the dull periods of last year, was a substantial one, $2,690,269.

Investors who analyze New York Edison's situation will be impressed with the company's gains in gross business, but to them a still more impressive achievement will be the improvement in net earnings. During the six-year period that gross earnings grew from $31,777,168 to $65,404,464 net earnings, after all expenses, taxes and replacement reserves, grew from $8,492,402 to $19,661,599. Net is, by reason of far-sighted policies adopted years ago and the introduction more recently of operating economies, increasing faster relatively than gross. Surplus earnings plowed back into plant over a long period of years are now being reflected in better earnings on the outstanding securities. To obtain its increased earning power the company has, of course, been obliged to swell the funded debt, but interest charges increased only from $2 911,174 in 1918 to $4,847.103 in 1924. The significance of the figures lies in the fact that between 1918 and 1924 to obtain a 136 per cent increase in net earnings it swelled its charges on funded and unfunded debt only 66 per cent.

Although the New York Edison Company and the United Electric Light & Power Company have spent more than $175,000,000 since 1903 for permanent extensions and additions, only 18 per cent of that amount has been funded. The remaining $145,000,000 has been financed through the issue of stock, temporary obligations and the use of treasury funds.

The company now is able as a result of such policies to borrow at the lowest rates available in the market for utility loans, a fact that recently was shown when New York Edison's bankers retailed a thirty-million-dollar issue of first lien and refunding mortgage 5 per cent bonds at par. No power and light bonds command a better investment rating than those recognized generally as applying to underlying New York Edison obligations.




NEW YORK EDISON EARNINGS INCREASE SUBSTANTIALLY IN SEVEN-YEAR PERIOD

From the standpoint both of earnings and property values the bonds are protected by margins substantially wider than are usually required by investors of discrimination. Annual interest charges on the company's funded debt, including requirements on the recent thirty-million-dollar issue, aggregate $5,144,920. It is to be presumed that the new money will help to swell earnings in the future, but net earnings even for 1924 were $19,661,599, or nearly four times present requirements. Operating properties of the system represent an investment of about $278,000,000 as compared with bonds outstanding to the amount of only $98,076,000.

## Company Reports

Among the company reports issued for the month of January during the past week are the following:

| Name of Company | Gross Revenue for January 1925 | 1924 |
|---|---|---|
| Bangor Railway & Electric | $146,973 | $143,078 |
| Baton Rouge Electric | 74,018 | 64,154 |
| Binghamton Light, Heat & Pwr. | 152,609 | 118,877 |
| Blackstone Valley Gas & Elec. | 474,056 | 427,033 |
| Central Illinois Light | 376,891 | 356,173 |
| Central Mississippi Valley Elec | 59,626 | 58,717 |
| Columbus Electric & Power | 233,519 | 206,373 |
| Consumers Power | 1,788,458 | 1,744,892 |
| Eastern Texas Electric | 215,925 | 186,819 |
| Edison Elec. Illg. Co. of Brockton | 171,429 | 153,303 |
| El Paso Electric | 223,606 | 219,355 |
| Galveston & Houston Elec. | 326,122 | 283,324 |
| General Gas & Elec. | 1,933,927 | 1,406,709 |
| Houghton County Elec. Lt. | 52,814 | 53,282 |
| Idaho Power | 225,744 | 217,789 |
| Lowell Electric Lt. | 158,180 | 150,595 |
| Metropolitan Edison | 772,802 | 705,579 |
| Mississippi River Power | 236,922 | 241,864 |
| New Jersey Power & Light | 113,001 | 94,607 |
| Northern Texas Electric | 220,530 | 246,105 |
| Paducah Electric | 60,220 | 60,669 |
| Pennsylvania Edison | 275,026 | 283,872 |
| Portland Electric Power | 971,332 | 960,202 |
| Savannah Elec. & Power | 170,238 | 172,167 |
| Sierra Pacific Electric | 100,329 | 87,695 |
| Southern Canada Power | 100,250 | 92,750 |
| Southern Indiana Gas & Elec. | 250,723 | 244,746 |
| Tampa Electric | 264,975 | 209,241 |
| Utah Securities | 1,019,522 | 980,773 |
| Vermont Hydro-Electric | 69,088 | 59,034 |

## Dividends Declared

The following quarterly dividends were announced by central station companies and electrical manufacturing companies during the past week.

| Nane of Company | Per Cent | When Payable |
|---|---|---|
| American & Foreign Power, pf. | $1.75 | Apr. 1 |
| American Public Service, pf. | 1¾ | Apr. 1 |
| American Public Utilities, pr. pf. | 1¾ | Apr. 1 |
| American Public Utilities, ptc. pf. | 1¾ | Apr. 1 |
| Associated Gas & Elec., Class A | 50c | May 1 |
| Bangor Ry. & Elec., pf. | 1¾ | Apr. 1 |
| Central States Elec., pf. | 1¾ | Apr. 1 |
| Continental Gas & Elec., com. | $1.10 | Apr. 1 |
| Continental Gas & Elec., pr. prefer. | 1¾ | Apr. 1 |
| Continental Gas & Elec., ptc. pf. | 1¾ | Apr. 1 |
| Continental Gas & El., ptc. pf.(ex.) | ¾ | Apr. 1 |
| Continental Gas & Elec., pf. | 1¾ | Apr. 1 |
| Detroit Edison | 2 | Apr. 15 |
| El Paso Electric, com. | $1.25 | Mar. 16 |
| El Paso Electric, pf., series A | 1¾ | Apr. 1 |
| El Paso Electric, pf., Series B | 1¾ | Apr. 1 |
| Galveston & Houston Elec., pf. | 3 | Mar. 16 |
| Kansas City Pwr. & Lt., pf. A | $1.75 | Apr. 1 |
| Massachusetts Lighting, com. | 75c | Mar. 31 |
| Massachusetts Lighting, 6% pf. | 1½ | Apr. 15 |
| Massachusetts Lighting, 8% pf. | 2 | Apr. 15 |
| Mississippi River Power, pf. | 1¾ | Apr. 1 |
| Montreal Tramways, deb. stock | 2½ | Apr. 1 |
| Newport News & Hampton Ry., Gas & Elec., pf. | 1¾ | Apr. 1 |
| Niagara, Lockport & Ontario Pwr., com. | 50c | Apr. 1 |
| Niagara, Lockport & Ontario Pwr., pf | 1¾ | Apr. 1 |
| Penn Central Light & Power, com. | 37½c | Apr. 1 |
| Penn Central Lt. & Pwr., com. (ex.) | 10c | Apr. 1 |
| Penn Central Lt. & Pwr., pf. | $1 | Apr. 1 |
| Penn Central Lt. & Pwr., pref. (ex.) | 10c | Apr. 1 |
| Portland Elec. Pwr., 1st pf. | 1¾ | Apr. 1 |
| Portland Elec. Pwr., pr. preference | 1¾ | Apr. 1 |
| Public Service Corp. of N. J., com. | $1.25 | Mar. 31 |
| Public Service Corp. of N. J., 8% pf. | 2 | Mar. 31 |
| Public Service Corp. of N. J., 7% pf | 1¾ | Mar. 31 |
| Southern Canada Power, pf. | 1¼ | Apr. 15 |
| Utah Power & Light, pf. | 1¾ | Apr. 1 |
| Allis-Chalmers Mfg., pf. | 1¾ | Apr. 15 |
| Canadian General Elec., pf. | 1¾ | Apr. 1 |
| Emerson Electric Mfg. pf. | 1¾ | Apr. 1 |
| Manhattan Electric Supply | $1 | Apr. 1 |
| Western Electric, com. | $2.50 | Mar. 31 |
| Western Electric, pf. | 1¾ | Mar. 20 |
| Weston Elec'tl Instrument, Class A | 50c | Apr. 1 |

**Serv-el Corporation to Offer Stock.**—The Serv-el Corporation, Chicago, recently formed to handle the Serv-el electric refrigerator manufactured by the National Electric Products Company, Chicago, will shortly offer 100,000 shares of stock through Watson & White, New York. A total of 200,000 shares has been authorized, which, including 80,000 shares held by the originators, will make a total of 180,000 shares outstanding.

# Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stocks is $100.)

| Companies | Bid Price Saturday, March 7 | Low 1925 | High 1925 |
|---|---|---|---|
| **PREFERRED STOCKS** | | | |
| **Operating Companies** | | | |
| Adirondack Power & Light 7 per cent | 99 | 98 | 101 |
| Appalachian Power, 7 per cent | 97½ | 92 | 100 |
| Arkansas Light & Power 7 per cent | 94 | 92 | 98 |
| Asheville Power & Light 7 per cent | a 99 | 99 | 100 |
| Central Illinois Public Service 6 per cent | 84½ | 84 | 87 |
| Colorado Power 7 per cent | 93 | 93 | 98 |
| Connecticut Light & Power 7 per cent | 105 | 105 | 110 |
| Consumers' Power 6 per cent | 91½ | 90 | 93½ |
| Dayton Power & Light 6 per cent | 94 | 88 | 100 |
| Duquesne Light 7 per cent | a106½ | 105 | 107½ |
| Eastern Texas Electric 6 per cent | 100 | 100 | 105 |
| Empire District Electric 6 per cent | 78 | 78 | 85 |
| Fort Worth Power & Light 7 per cent | a101 | 100 | 102 |
| Great Western Power 7 per cent | 96½ | ... | ... |
| Illinois Northern Utilities 6 per cent | 88 | 82 | 92 |
| Illinois Power & Light 7 per cent | 94½ | 92½ | 98 |
| Kansas Gas & Electric 7 per cent | a 98 | 98 | 100 |
| Long Island Lighting 7 per cent | 101½ | 100 | 105 |
| Minnesota Power & Light 7 per cent | a 96 | 96 | 98 |
| Mississippi River Power 6 per cent | 89 | 87½ | 91 |
| Nebraska Power 7 per cent | a 98 | 98 | 100 |
| Niagara Falls Power 7 per cent—25 | 28 | 28 | 29 |
| Niagara, Lockport & Ont. Power 7 per cent | 106 | 101½ | 110 |
| Northern States Power 7 per cent | 97 | 95 | 100 |
| Ohio Public Service 7 per cent | 97½ | 97 | 100 |
| Pacific Gas & Electric 6 per cent | 95 | 92 | 97 |
| Pacific Power & Light 7 per cent | a 99 | 98 | 100 |
| Penn-Ohio Power & Light 7 per cent | 93 | 91 | 97 |
| Pennsylvania Power & Light $7—no par | a101 | 100 | 101½ |
| Penn. Public Service 7 per cent | 90 | 90 | 100 |
| ‡Philadelphia Electric 8 per cent—25 | 43½ | 40 | 45 |
| Southern California Edison 8 per cent | 116 | 115 | 120 |
| Tennessee Electric Power, 6 per cent | 82 | 80 | 84 |
| Texas Power & Light 7 per cent | a100 | 100 | 101 |
| Utah Power & Light 7 per cent | a 99 | 99 | 100 |
| Western States Gas & Electric 7 per cent | 82 | 82 | 85 |
| Yadkin River Power, 7 per cent | a 99 | 98 | 100 |
| **Holding Companies** | | | |
| American Gas & Electric 6 per cent—50 | 44½ | 44 | 47½ |
| American Light & Traction | 93½ | 93 | 95½ |
| American Power & Light 6 per cent | 87½ | 86 | 90 |
| American Public Service 7 per cent | 87 | 87 | 92 |
| American Public Utilities 7 per cent | 87 | 87 | 95 |
| American Water Works & Electric 7 per cent | 103 | 100 | 103 |
| Associated Gas & Electric 7 per cent—1 per cent extra—50 | a 50 | ... | ... |
| Carolina Power & Light 7 per cent | 101½ | 100 | 105 |
| Central Indiana Power 7 per cent | 88½ | 88 | 93 |
| Cities Service 6 per cent | 81 | 80 | 83 |
| Commonwealth Power 6 per cent | 80½ | 80 | 82½ |
| Consolidated Gas 6 per cent—50 | 57½ | 57½ | 58½ |
| Continental Gas & Electric 7 per cent pr. pf | 91 | 89 | 95 |
| Electric Bond & Share 6 per cent | 102½ | 102 | 103½ |
| General Gas & Electric—$8—no par | 107 | 104½ | 110 |
| *Middle West Utilities 7 per cent | 94½ | 91½ | 95 |
| National Power & Light—$7—no par | 96 | 95 | 99 |
| North American 6 per cent—50 | a 48½ | 46½ | 49 |
| Public Service Corp. of N. J. 7 per cent | 100½ | 99 | 102 |
| Public Service Corp. of N. J. 8 per cent | 109 | 110 | 112½ |
| Standard Gas & Electric 8 per cent—50 | 52 | ... | ... |
| ‡United Gas Improvement—50 | 58½ | 57 | 58½ |
| United Light & Power—$6.50—no par | 85 | 83 | 88 |
| **COMMON STOCKS** | | | |
| **Operating Companies** | | | |
| Adirondack Power & Light—50 | 37 | 31 | 41 |
| Appalachian Power—no par | 76 | 70 | 83 |
| Arkansas Light & Power | 75 | 65 | 85 |
| Brooklyn Edison | 128½ | 120½ | 133 |
| Buffalo General Electric | 240 | 197 | 245 |
| Colorado Power | a 33 | ... | ... |
| *Commonwealth Edison | 137½ | 134½ | 139 |
| §Consolidated Gas, Electric Light & Power | 34½ | 32 | 35½ |
| Dayton Power & Light | 420 | 180 | 460 |
| Detroit Edison | a118 | 110 | 119 |
| \|\| Edison Electric Illuminating of Boston | 201 | 200 | 206 |
| Kentucky Hydro-Electric | a 90½ | ... | ... |
| Long Island Lighting | 250 | ... | ... |
| Mississippi River Power | 37 | 37 | 40 |
| Montana Power | a 67 | 66½ | 72 |
| Niagara Falls Power—no par | 46 | 43 | 48 |
| Niagara, Lockport & Ontario Power—no par | 63 | 63 | 73 |
| Northern Ohio Power | 6½ | 5 | 7½ |
| Northern States Power | 107 | 103 | 110 |
| North Texas Electric | 62 | 62 | 67 |
| Pacific Gas & Electric | a106½ | 102½ | 108½ |
| Penn Central Light & Power—no par | 64½ | 60 | 64½ |
| §Pennsylvania Water & Power | 132½ | 126½ | 133½ |
| ‡Philadelphia Electric—25 | 44 | 40½ | 45½ |
| Public Service Co. of Northern Illinois | 114 | 97 | 116 |
| Puget Sound Power & Light | 52 | 51 | 58 |
| Southern California Edison | 103 | 102 | 106 |
| Tennessee Electric Power—no par | 52½ | 47 | 61 |
| Virginia Power | 65 | 65 | 92 |
| Virginia Railway & Power | a 80 | 64½ | 86½ |
| West Penn. Co. | a108 | 105 | 120 |
| **Holding Companies** | | | |
| American Gas & Electric—no par | 72 | 70 | 80 |
| American Light & Traction | 146 | 139 | 153 |
| American Power & Light | 55½ | 53 | 67 |
| American Public Utilities | 70 | 70 | 85 |
| American Water Works & Electric | a 38 | 34½ | 3[illegible] |
| Carolina Power & Light—no par | 320 | 290 | 3[illegible] |
| Cities Service | 200 | 172 | 210 |
| Columbia Gas & Electric—no par | a 56½ | 45½ | 59 |
| Commonwealth Power Corp.—no par | 111 | 106 | 126 |
| Consolidated Gas—no par | a 76½ | 74½ | 78½ |
| Continental Gas & Electric | 87 | 80 | 90 |
| Federal Light and Traction | a145½ | 114½ | 148½ |
| General Gas & Electric | 73 | 72 | 81 |
| Lehigh Power Securities—no par | 97 | 82 | 116 |
| *Middle West Utilities—no par | 91½ | 82½ | 91½ |
| National Power & Light—no par | 211 | 185 | 230 |
| North American—10 | a 47½ | 41½ | 49 |
| Philadelphia Co.—50 | a 54½ | 52½ | 57½ |
| Power Securities—no par | 18 | ... | ... |
| Public Service Corp. of N. J.—no par | a 69½ | 67½ | 72 |
| Standard Gas & Electric—no par | a 45½ | 40½ | 47½ |
| United Gas & Electric (Conn.)—no par | 31 | 26 | 37½ |
| Utah Securities | a 56½ | 41½ | 56½ |
| **BONDS** | | | |
| **Operating Companies** | | | |
| Adirondack Power & Light 6s 1950 | 104½ | 102½ | 105 |
| Alabama Power 5s 1946 | 97 | 96 | 97½ |
| Appalachian Power 5s 1941 | 97 | 96 | 97½ |
| Brooklyn Edison 5s 1949 | 99⅞ | 99½ | 100 |
| 6s 1930 | 104½ | 104½ | 105 |
| Cleveland Electric Illuminating 5s 1939 | 100½ | 100 | 101½ |
| Commonwealth Edison 5s 1943 | 100 | 99½ | 100½ |
| 5s 1953 | 99 | 98½ | 99½ |
| §Consol. Gas, Elec. Lt. & Pwr. 4½s 1935 | 97 | 95½ | 97½ |
| Consumers' Power 5s 1936 | 99 | 99 | 99½ |
| 5s 1952 | 94½ | 90½ | 95½ |
| Detroit Edison 5s 1933 | 101½ | 100 | 102½ |
| Duquesne Light 6s 1949 | 106 | 105 | 107 |
| Great Western Power 5s 1946 | 96½ | 95 | 97½ |
| Kansas City Power & Light 5s 1952 | 97½ | 95½ | 97½ |
| Mississippi River Power 5s 1951 | 98 | 96½ | 98½ |
| Montana Power 5s 1943 | 99½ | 97½ | 99½ |
| New England Power 5s 1951 | 100½ | 100½ | 101½ |
| New York Edison 6½s 1941 | 114½ | 112½ | 115 |
| Niagara Falls Power 6s 1950 | 106½ | 105 | 106½ |
| Northern States Power 5s 1941 | 95½ | 93 | 96½ |
| 6s 1941 | 105½ | 103 | 105½ |
| Ohio Power 7s 1951 | 106½ | 106½ | 107½ |
| Pacific Gas & Electric 5s 1942 | 94½ | 93½ | 96 |
| Pennsylvania Water & Power 5s 1940 | 100½ | 100 | 100½ |
| ‡Philadelphia Electric 5s 1966 | 101½ | 100½ | 102 |
| 5½s 1947 | 104½ | 103½ | 105 |
| 6s 1941 | 107 | 106 | 107½ |
| Portland Electric Power 6s 1947 | 97½ | 94 | 99½ |
| Southern California Edison 5s 1939 | 99½ | 99½ | 100 |
| 6s 1944 | 103½ | 102½ | 104½ |
| Tennessee Electric Power 6s 1947 | 101½ | 99½ | 102 |
| Texas Power & Light 5s 1937 | 97½ | 97 | 98 |
| Toledo Edison 7s 1941 | 109⅞ | 108½ | 110 |
| Utah Power & Light 5s 1944 | 94 | 91 | 95½ |
| **Holding Companies** | | | |
| Alabama Traction, Light & Power 5s 1962 | 85½ | 85½ | 87½ |
| American Gas & Electric 6s 2014 | 96½ | 96½ | 97 |
| American Power & Light 6s 2016 | 95 | 94 | 95½ |
| Amer. Water Works & Electric 5s 1934 | 95½ | 92½ | 96½ |
| Associated Gas & Electric 6½s 1954 | a 98½ | ... | ... |
| Central Indiana Power 6s 1947 | 98 | 95½ | 98½ |
| Commonwealth Power 6s 1947 | 100½ | 97½ | 101 |
| Consolidated Cities Lt., Pwr. & Tr. 5s 1962 | 79½ | 75½ | 80 |
| Illinois Power & Light 6s 1953 | 101½ | 100½ | 101½ |
| United Light & Railways 5s 1932 | 95 | 93½ | 95 |
| 6s 1952 | 97½ | 95½ | 97½ |
| **ELECTRICAL MANUFACTURING COMPANIES** | | | |
| **PREFERRED STOCKS** | | | |
| Allis-Chalmers Manufacturing | 105 | 103½ | 107 |
| *National Carbon | 120 | 120 | 124 |
| Worthington Pump & Machinery A | a 86½ | 85 | 88 |
| **COMMON STOCKS** | | | |
| Allis-Chalmers Manufacturing | a 81⅞ | 71½ | 82⅞ |
| American Bosch Magneto—no par | a 37½ | 33 | 54½ |
| Electric Storage Battery—no par | a 65 | 62⅜ | 70½ |
| General Electric | a263 | 227½ | 320 |
| General Electric—10 | a 11½ | 11 | 11½ |
| *Hurley Machine—no par | 49½ | 47 | 56 |
| †Wagner Electric | 38 | 26½ | 50 |
| Westinghouse Electric & Manufacturing—50 | a 73½ | 69½ | 84 |
| Worthington Pump & Machinery | a 68½ | 62½ | 79½ |
| **BONDS** | | | |
| Canadian General Electric 6s 1942 | 107½ | 107½ | 107⅞ |
| General Electric 3½s 1942 | 82½ | 82½ | 84 |
| 5s 1952 | 103½ | 101½ | 105½ |
| Robbins & Myers 7s 1952 | 68 | 67 | 73½ |
| Western Electric 5s 1944 | 98½ | 98½ | 99½ |
| Westinghouse Electric & Mfg. 7s 1931 | 107½ | 107½ | 108½ |

*Chicago Stock Exchange. †St. Louis Stock Exchange. ‡Philadelphia Stock Exchange. || Boston Stock Exchange § Baltimore Stock Exchange.
a Bid price, low and high, Tuesday, March 10.